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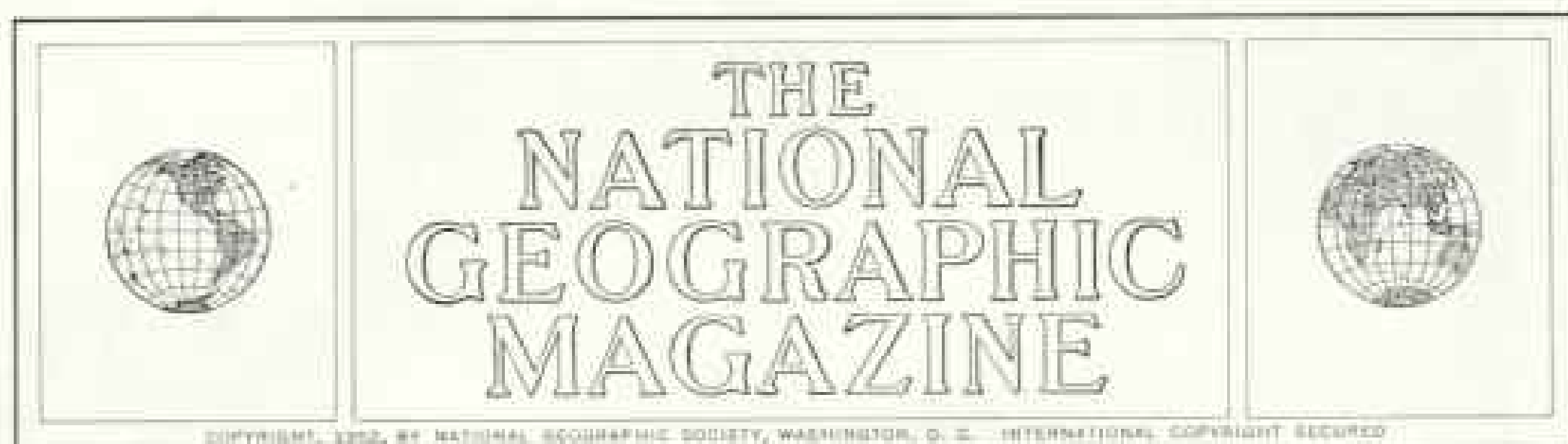
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Across the Potomac from Washington

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Growing Pains Afflict Arlington County and Alexandria as the Nation's Capital Overflows into Near-by Virginia

BY ALBERT W. ATWOOD

THE NERVE center of our national defense is not in Washington, D. C., as one might gather from newspapers, radio, and television, but across the Potomac River in Virginia.

Until recently a nondescript no man's land, the three-mile Virginia strip between Arlington Memorial Bridge and historic Alexandria is now dominated by that incredible building the Pentagon.

Symbol and center of our military power, the huge structure is the headquarters of the Joint Chiefs of Staff and all those branches of the Army, Navy, and Air Force which must be in close touch with one another and with the top command.

Unofficial Adjunct to the Capital

The average American citizen might well regard the Pentagon as the most important building in the world. Here are devised measures to protect our lives and property from foreign aggressors.

At Pentagon desks sit men and women, in and out of uniform, directing activities which take the largest single bite out of the taxpayer's dollar. Military expenditures will account for 67 percent of the \$79,067,000,000 to be spent according to the Federal budget for fiscal 1953.

Although the Pentagon is not in Washington, it might as well be for all practical purposes. Back in 1791 George Washington chose a plot of land 10 miles square, straddling the Potomac, as a site for a National Capital. But the original Federal City was built entirely on the Maryland side, and in 1846 Congress permitted the Virginia part to retrocede to the State.

Today, however, this Virginia strip has become a great, if unofficial, adjunct capital, and into it both the activities and the residents of Washington continue to pour with irresistible force.

Heart, hub, and pivot of this new Virginia metropolis is the Pentagon, the world's largest office building, in which 32,000 defense workers find room (pages 12-13).

Most of the building is open to the public during normal working hours, but there are some areas which only a selected few may enter. Among these are the headquarters of the Joint Chiefs of Staff and the Research and Development Board.

Built in World War II as headquarters for the War Department, the Pentagon was originally dubbed "Somervell's Folly," after Gen. Brehon Somervell, of the Army Engineers, who built it.*

But it has proved anything but folly, having saved a vast sum in rent formerly paid for the use of privately owned buildings. Every effort has been made to concentrate related activities and to prevent costly scattering throughout the vast spaces.

"Prisoners of the Pentagon"

Agreeing that the building, with its air-conditioning and wide corridors, is a comfortable place to work, its occupants nonetheless describe themselves as "prisoners of the Pentagon."

This is because it is almost impossible to leave at lunchtime. Restaurants are too far away, and there is danger of losing one's park-

* See "Wartime Washington," by William H. Nicholas, NATIONAL GEOGRAPHIC MAGAZINE, September, 1943.



Top Brass: The Joint Chiefs of Staff Meet in a Guarded Pentagon Room

Arlington County, Virginia, contains both the Pentagon, where the defense chiefs work, and Fort Myer, where many of them live. Keeping America strong is the responsibility of Gen. J. Lawton Collins, Chief of Staff of the Army; Gen. Hoyt S. Vandenberg, Chief of Staff of the Air Force; General of the Army Omar N. Bradley, Chairman of the Joint Chiefs, and Admiral William M. Fechteler, Chief of Naval Operations.

ing space. Besides, if the worker is not of high official rank, his parking space is at a great distance from the building.

To provide close-in parking for 32,000 people working in one building is impossible, and more assignments are made than there are actual spaces. Thus the latecomer gets left, or illegally uses someone else's space. Parking violations run as high as 250 a week. Consequently, many workers arrive before breakfast to assure parking.

The building has ample eating facilities, ranging from stand-up snack bars to the private dining room of the Secretary. There are four public cafeterias, two for officers, and dining rooms for top brass and high executives. Many a vacuum jug of coffee is taken from the snack bars to lunchtime conferences of generals and admirals. In summer employees enjoy an open-air cafe in the inner court (page 14).

The Pentagon's vast concourse, with its many stores and its changing exhibits, is of un-

failing interest to visitors (page 15). Exhibits which have attracted special attention were of jet engines, submarines, photography, handicrafts by enlisted men, and military decorations and medals.

Here also is MARS, headquarters of the Army and Air Force Military Affiliate Radio System. This station exists to create interest in radio and to train hams for military communications in the event of war.

Floor Plan Easy to Follow

There are many jokes about getting lost in the Pentagon's labyrinth of rings, corridors, ramps, and escalators. Actually, a study of the little map handed out at reception desks reveals the building's plan as strikingly simple.

The five floors are laid out in five concentric rings, like those of a tree, lettered A, B, C, D, E. Ten numbered corridors, radiating from the inner ring like the spokes of a wheel, intersect the rings.

Thus, a visitor looking for room 4D620



Parkington, Arlington's New Shopping Center, Woos Customers with 5-cent Parking

Washington traffic, like that in other big cities, is so dense that motor-borne trade is gravitating to suburbs. The Hecht Co., a downtown department store, caters to Virginia motorists with a \$15,000,000 business center. For a nickel, any shopper may park three hours in Hecht's 2,000-car depot, one of the world's largest, and shop at any of 19 stores in the development. These customers drove out from Washington.

would first take a ramp or escalator to the fourth floor. Then he would proceed to ring D and follow the signs to corridor 6 and room 20.

Even so, many take a wrong turn, or strike out boldly without consulting the map, and soon find themselves wandering hopelessly over some 17 miles of corridors. Some executives send guides to meet callers and pilot them to their destinations.

Pentagon Too Big for Washington

One of the Pentagon's most remarkable features is Liberty 5-6700, the telephone exchange that handles about 105,000 calls a day for the Department of Defense. Five switchboards are operated so efficiently that calls are connected almost instantly with any one of more than 43,000 extensions.

Too big for downtown Washington, the Pentagon was built beyond the Potomac, and it is difficult to see how the site could have been more magnificently improved. Highways

to the building are arranged to give much-needed approaches to the river crossings and to Washington from the south and west (map, page 7).

Scarcely more than a mile from the Pentagon and less than four miles from the heart of downtown Washington is one of the great air crossroads of the world, the Washington National Airport (pages 26 and 27).

Second largest in the country in airline operations, it is distinctive among great airports in its strategic location and in its proximity to the main features, both military and civil, of the metropolitan area which it serves. It is thus in contrast with the airports of most large cities, which are seven or eight miles from their metropolitan centers.

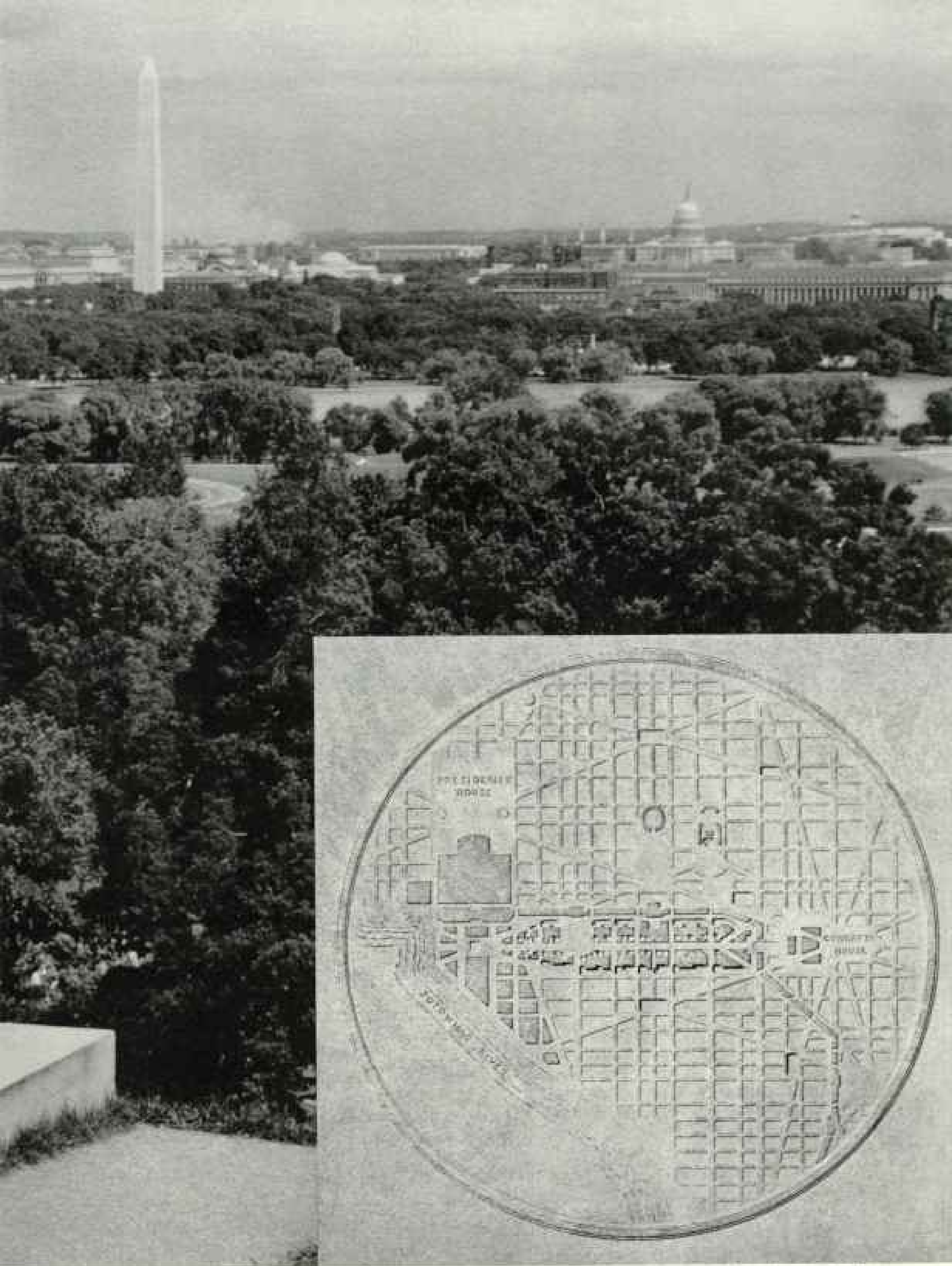
This civilian airport, the only one owned and operated by the Government, is the landing and taking-off place for the President, foreign rulers, statesmen, and diplomats.

The field is extraordinarily convenient for the use of the services. The military rents a



From the Lawn of Lee Mansion, All Washington Lies at the Viewer's Feet

This hillside, once a part of Robert E. Lee's home, stands in Arlington National Cemetery. Visitors survey the National Capital from columned Lincoln Memorial (left) to the Library of Congress (small dome at far right).



Pierre Charles L'Enfant's Monument Overlooks the Capital He Conceived in 1791

French-born Major L'Enfant, hired by George Washington to design the Capital, lost his job and died in poverty, yet the city largely followed his design. The top of L'Enfant's tomb (left) bears his plan (inset).



Arlington Third-graders Invade a Supermarket for an Arithmetic Lesson

Students arrived at Kate Waller Barrett School with cash and shopping lists supplied by parents, then marched to a store to test their knowledge of figures. Not one strayed from his list by so much as a candy bar.

hangar from the airport, just as the civil airlines do, where planes are serviced and maintained.

Many of the arrivals and departures of dignitaries, often men who are shaping the destinies of the world, are accompanied by elaborate ceremonies, with military detachments, welcoming officials, and all that goes with such occasions.

At times the take-offs and landings total two a minute. With such a flow and with the constant coming and going of celebrities, the very air seems charged with excitement and the pulse beat of adventure.

This is primarily a domestic airport, with many daily flights to New York City, Chicago, the west coast, and other points in the United States. But it has such international facilities as customs, immigration, and public health, and becomes a direct point for international civilian flights when La Guardia or other east-coast airports are closed down.

Despite a recently completed large addition to the main building, and despite every technical improvement and modern device, aircraft are forced to double park at times, even with 16 gate positions available.

Air lanes for getting in are saturated, ideal

efficiency is unfavorably affected by very close proximity to military airfields, and the total area is small.

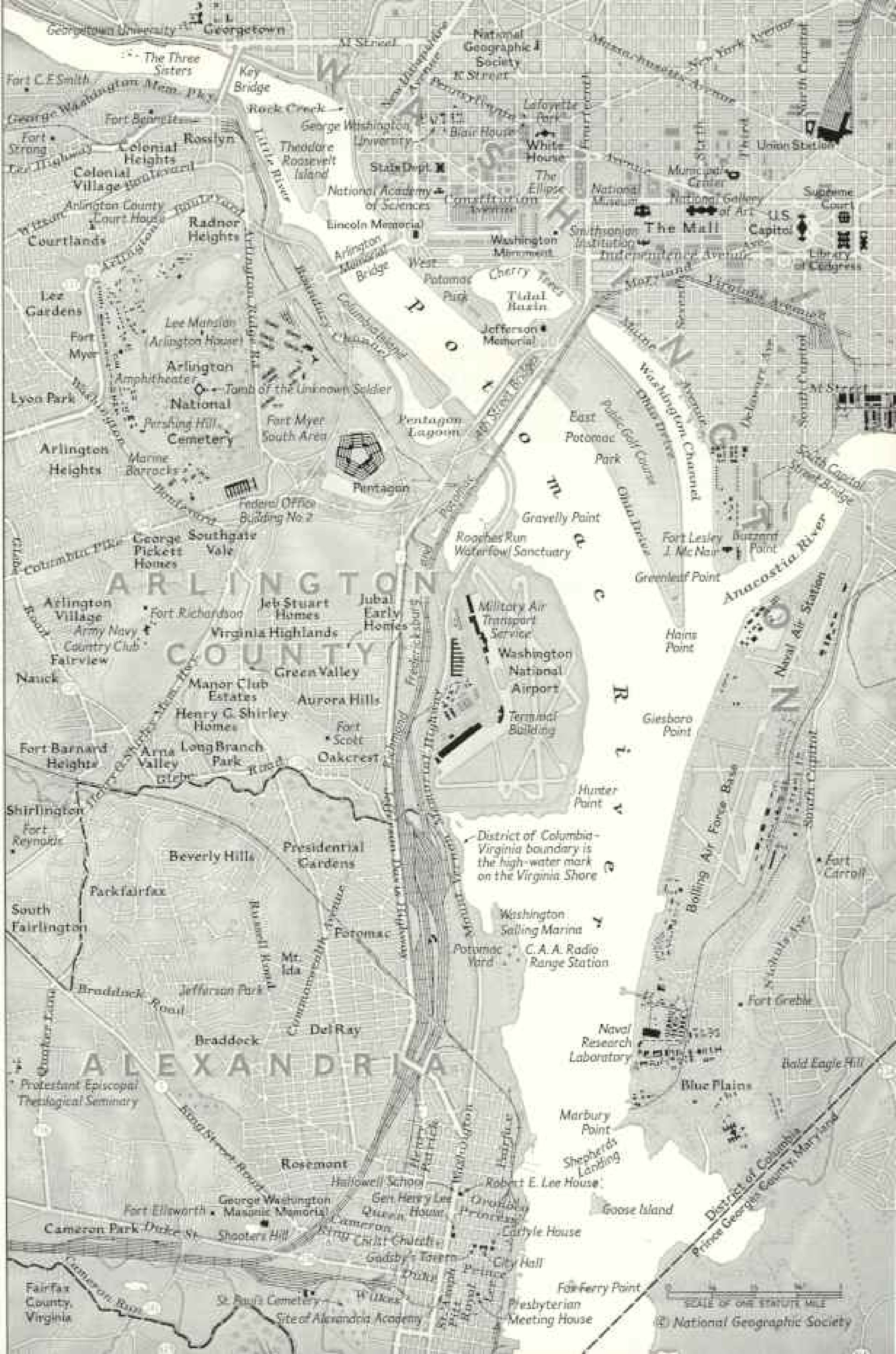
When the port was planned in 1938, largely at the instance of President Franklin D. Roosevelt, as a model for other airports, a great war was not foreseen. One result of that war has been larger and ever larger commercial aircraft, making further adjustments in the port's gate positions necessary.

Officials have declared that Washington must have a new and larger airport by 1955. A plan to build on a 4,500-acre tract at Burke, in Fairfax County, Virginia, was vigorously protested by landowners who faced condemnation proceedings. The project reached stalemate when Congress failed to vote necessary funds.

In sharp contrast with the teeming activity

Tidewater Potomac Separates Washington from Its Virginia Suburbs

Navy ships enter the Anacostia River, ocean-going yachts dock in Washington Channel, and barges approach Key Bridge, but rapids bar navigation beyond that point. Arlington and Alexandria areas once belonged to the District of Columbia, but Congress returned them to Virginia in 1846.



of the Pentagon and airport is a neighboring reservation of intense interest to every patriotic American—Arlington National Cemetery, one of the great shrines of the Nation.*

Resting Place of Nation's Heroes

In the Pentagon military strategy is planned, and from the airport our commanders fly to the ends of the earth. But in the serene peace and beauty of near-by Arlington lie many of our honored dead—heroes of all our wars.

Total burials exceed 77,000, and average eleven a day, with none on Sundays or holidays. Generally, anyone connected with the armed services, during war or peace, dying in the service or having been honorably discharged, is entitled to burial without charge.

The rolling, hilly terrain, the winding drives, the 22,000 carefully tended trees, the beautiful landscaping, and the ever-changing vistas of Washington, especially of the Washington Monument and the Lincoln Memorial—all combine to make of the cemetery a place of rare and haunting beauty.

I, for one, am most drawn to it on a brisk, clear October afternoon. Unfortunately, most of the thousands who visit Arlington follow only one or two of the drives, but a leisurely tour of the entire grounds is a fine investment.

The point of greatest interest is the Tomb of the Unknown Soldier, visited by about 4,000 people a day. There are 4,720 unknown soldiers in Arlington, but one was selected as a focus for the Nation's gratitude to all its war dead.

The tomb, a great block of marble, is striking in its simplicity. It is guarded by marching soldiers 24 hours a day.

The new guard takes over from the old every hour in a little ceremony beside the tomb, with the corporal of the guard barking commands.

"Daddy," exclaimed a 3-year-old after his first visit to Arlington, "I saw the unknown soldier walking up and down!"

Detail Regarded as Honor

Only under exceptional circumstances may a guard speak or otherwise disturb his silent, poker-faced bearing. If, for instance, he sees youngsters swinging on the ornamental chains around the tomb, he may warn them, but first he must bring his rifle from right or left shoulder to port. The rifle is always carried on the shoulder away from the tomb.

I was there once when the guard did have to speak to a child; the effect was startling, as if an automaton had come to life.

Visitors sometimes wonder if guarding the tomb in bad weather or at a time like Christmas is not a peculiarly lonely occupation. Guards say they consider it an honor at any

time. Company A, Third Infantry Regiment, stationed at adjoining Fort Myer, supplies men for the detail.

Back of the tomb is the great open-air marble Amphitheater, where Memorial Day and Armistice Day are observed, usually with the President in attendance (page 10).

The laying of wreaths on the tomb by the President, and by kings, queens, heads of state, ambassadors, and organizations of every kind has become a national and international custom. Appointments are sometimes made a year in advance.

The number of heroes buried in Arlington is so great that even to indicate the diversity of their achievements is almost impossible. There are the explorers Adm. Robert E. Peary and Adm. Charles Wilkes; medical heroes Maj. Walter Reed, Gen. William C. Gorgas, and Maj. Jonathan Letterman; noted Indian fighters and famous airmen.

On a little eminence, Pershing Hill, are the graves of General of the Armies John J. Pershing and General of the Air Force H. H. Arnold, air commander in World War II, both of whom served as trustees of the National Geographic Society.

Between them Gen. Walton H. Walker, killed in a jeep accident in Korea, was buried in January, 1951.

Grave of Father of Baseball

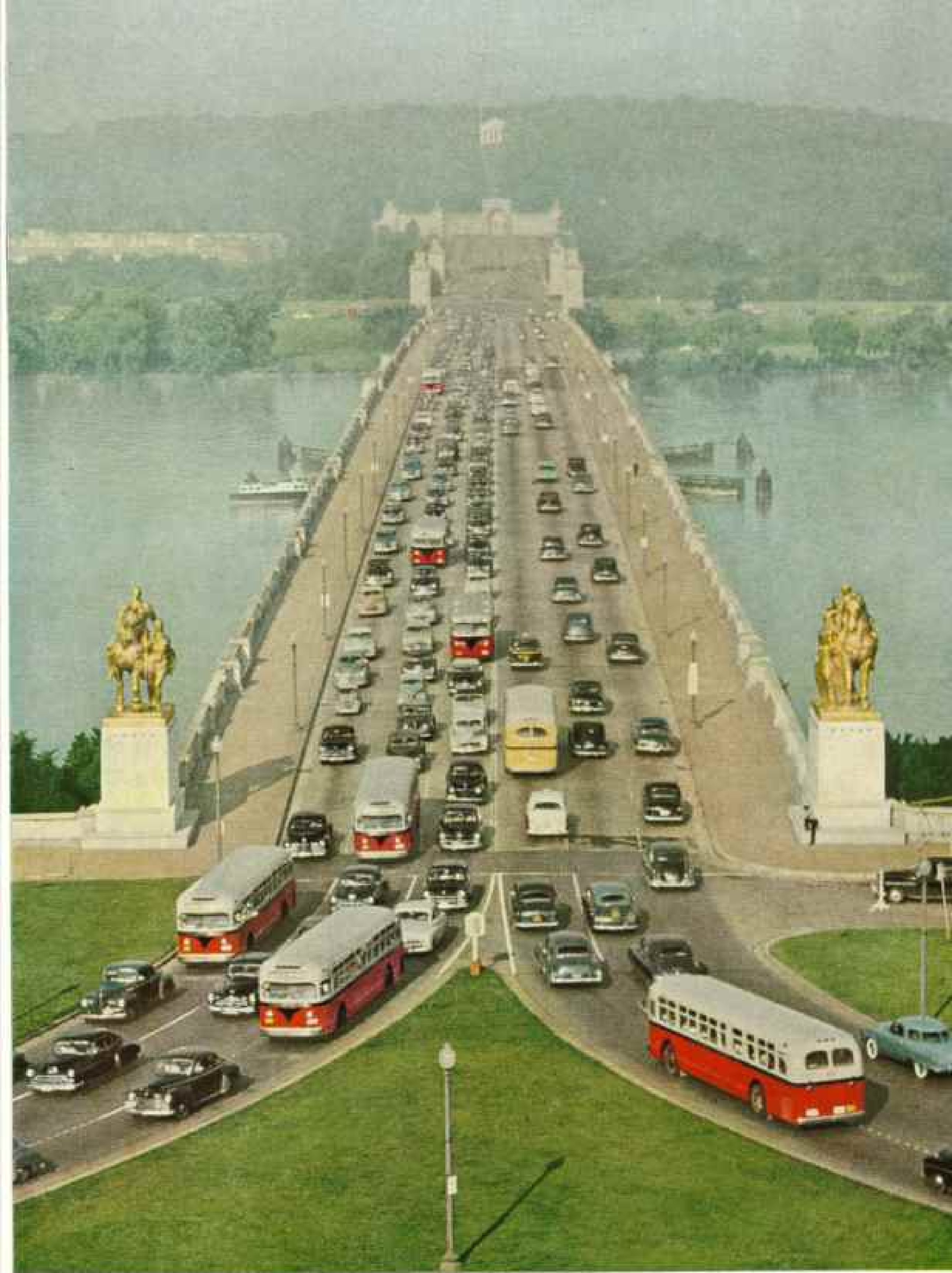
There are the graves of Gen. Abner Doubleday, acclaimed as the father of baseball, who aimed the first shot fired by Fort Sumter in reply to the Confederate bombardment in the Civil War; of Gen. Phil Sheridan; of Maj. Pierre Charles L'Enfant, who planned the city of Washington (pages 4-5).

Here lie more than 2,000 unknown dead from Bull Run; 229 men who lost their lives in the explosion of the battleship *Maine* in Habana Harbor, with the mast of the ship standing guard over the grave. Here also is the rarely visited grave of Private William Christman, the first burial to take place in Arlington, May 13, 1864.

Any visitor to Arlington is likely to witness a military funeral. These are impressive occasions, with flag-draped caisson, the caparisoned and riderless horse (when the deceased was of the rank of general or had been in the cavalry), the slowly marching troops, and the bugle sounding taps at the grave.

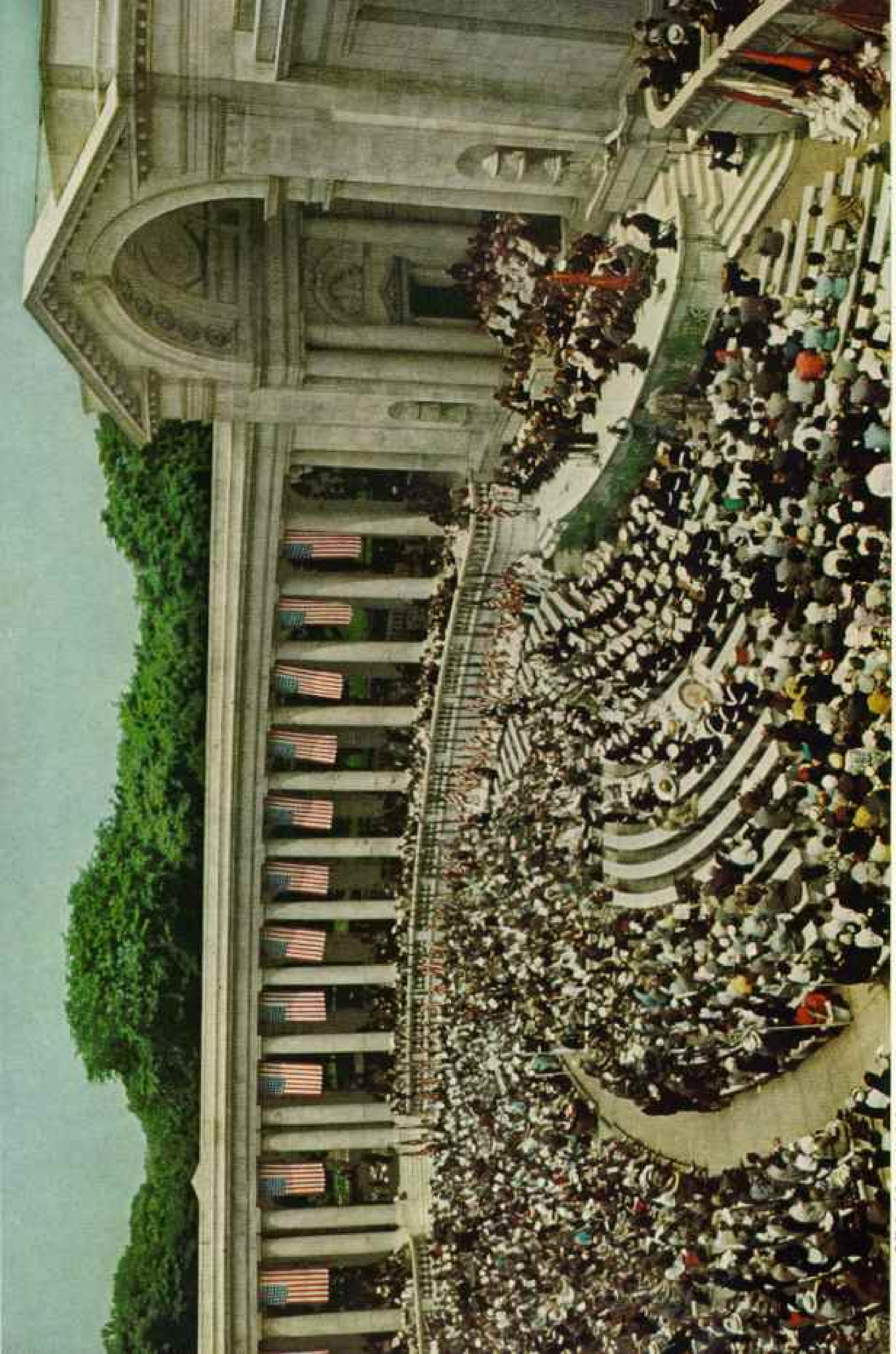
In November, 1950, I was privileged to attend the unveiling of a life-size, bronze equestrian statue of British Field Marshal Sir John Dill, who served on the Combined

* See, in the NATIONAL GEOGRAPHIC MAGAZINE: "Shrines of Each Patriot's Devotion," by Frederick G. Vosburgh, January, 1949, and "Fame's Eternal Camping Ground," by Enoch A. Chase, November, 1928.



Commuters by the Thousands Jam a Potomac River Bridge on Their Way to Work

Arlington Memorial Bridge, one of six linking Washington, D. C., and Virginia, carries some 56,000 cars a day. This early-morning view looks from Lincoln Memorial circle toward Arlington National Cemetery and the Robert E. Lee mansion on top of the hill. Equestrian statues were cast and gilded in Italy as a gift to America.



A General of the Army George C. Marshall Addresses a Memorial Day Throng in Arlington National Cemetery's Marble Amphitheater
→ Netherlands gift tulips brighten the grounds of the Amphitheater and the Tomb of the Unknown Soldier, which stand among 67,300 gravesites.

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Collaboration by National Geographic Photographer Robert P. Benson







Too Big to Fit into Crowded Washington, the 34-acre Pentagon Stands in Virginia

White House and Capitol are less than half an hour away across the 14th Street traffic bridges, which parallel the railroad span (right). Motorists often get lost in the 30 miles of access roads. Parking lots hold 8,300 cars.

Pentagon's Five Walls Enclose Grassy Court and Open-air Cafe

These girls, like 32,000 other workers, have a choice of 14 eating places in the Pentagon. Three private dining rooms serve the Secretary of Defense, generals, admirals, and other executives.

Altogether, the Litchens prepare some 18,500 meals and 30,000 cups of coffee a day.

Should this staggering intake give any employee indigestion, the building has two dispensaries and five first-aid stations.

The Pentagon's vastness, its 17 miles of corridors, and its unusual shape have provided material for many a joke. Most are concerned with getting lost.

Actually, it is hard to stay lost very long. Signs and maps offer directions at every hand. Some executives send guides to meet callers.

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Pentagon's Main Street Is the Concourse. Its Shops Were Set Up in Wartime to Keep Workers on the Job. The first employers had to take time off to shop in downtown Washington. Now they can use the building's own business center, including drugstore, bakery, florist's, jeweler's, department store, laundry, and bookstore (right). Cookbooks and books of humor are best sellers at Brentano's.

Contributions by National Geographic Photographer R. Anthony Stewart





Christ Church's White Woodwork Is Steeped in the History of Old Alexandria

Completed in 1773, the church has never missed a Sunday service. George Washington purchased a pew for £36.10s. Robert E. Lee owned another. Here the Rev. O. V. T. Chamberlain catechizes the Church School.

Chiefs of Staff in World War II and died in Washington in 1944; later an Act of Congress authorized his burial in Arlington.

A large audience waited to hear General of the Army George C. Marshall and President Harry S. Truman speak; only a few were aware that Mr. Truman's late arrival was due to the attempt a few minutes earlier to assassinate him at Blair House in Washington. Even two members of the Cabinet on the front row of seats did not know of it until just before the President arrived.

Cemetery Site Once Home of Lee

The cemetery is part of the original 1,100-acre Arlington plantation of George Washington Parke Custis, grandson of Martha Washington and adopted son of George Washington, who became the father-in-law of Robert E. Lee.

About a year before the end of the Civil War, 200 acres of the plantation were set aside as a resting place for soldiers who had died in the many near-by hospitals or whose bodies had been brought in from Bull Run and other battlefields; many Confederate dead were included.

Arlington House, the Custis plantation mansion, more recently known as the Lee Mansion, is directly across the river from Washington at the Virginia end of the superb Arlington Memorial Bridge (page 9). On the axis of the Lincoln Memorial and the long-time home of Lee, the bridge seems to symbolize the union of the North and the South and the nobility of two great leaders, Lincoln and Lee.

Lee Mansion, on the heights of Arlington, is one of the most attractive sights of the Nation's Capital. The view of Washington from its portico is positively breath-taking (pages 4-5), and, on the other hand, the old house absolutely dominates the scene as one approaches Virginia from Washington over the Memorial Bridge. The columns of its enormous portico stand out from across the Potomac. Wings were built on each side of the portico to balance the heavy columns, but large magnolia trees conceal them.

Custis, who built the house and lived there most of his life, was an artist, playwright, and agriculturalist. His fairs, or sheep-shearings, were a pioneer inspiration for present-day farm progress. He wrote what is believed to be the first play in America about railroads and brought a locomotive on the stage.

From the time Lee was married to Mary Custis at Arlington House in 1831 until he left 30 years later to become commander of the military and naval forces of Virginia, the mansion was the home to which he returned between tours of duty elsewhere.

His father-in-law had been the "child of Mount Vernon," and was long a very close living link with George Washington. It is no wonder, therefore, that Robert E. Lee was profoundly influenced by the character of Washington.

In April, 1861, Lee wrote his resignation from the United States Army in his bedroom at the house; two days later he left for Richmond, never to enter the mansion again. Federal troops later occupied it, and it became the headquarters of a commanding general. The once quiet country estate was transformed into a vast military encampment (page 19).

For many years the house was the office of the military cemetery that took the place of the plantation; more recently it has been taken over by the National Park Service as a memorial. As many as 19,000 school children have visited it in the month of April, the proverbial spring vacation month when Washington overflows with high-school pupils from every State.

Of about 75 forts which surrounded Washington in the Civil War, two remain in active service. One is Fort Myer, adjoining Arlington National Cemetery to the west; the other is Fort Lesley J. McNair in the District of Columbia.

The Virginia post was first called Fort Whipple for Gen. Amiel Weeks Whipple, of the Union Army, who died in the Civil War. It was renamed in 1881 in honor of Gen. Albert J. Myer, first chief of the Signal Corps, and became a cavalry post in 1887.

Fort Myer's horses are now used chiefly for ceremonial purposes. Its former riding hall serves today as a gymnasium.

Fort Myer Guards the Capital

This famous army post, however, has many practical, present-day uses. Besides providing men for official and ceremonial duties, its troops would protect the Capital in case of civil insurrection. It provides homes for the Army's highest ranking officers and serves as a services and supply center for the Washington area.

It is also the home of the 131-piece Army Band, established in 1922 by General Pershing, who also designed its original uniforms.

On a fine evening Washingtonians love to drive to Fort Myer to see the great flag lowered and hear the sunset gun and a recorded bugling of retreat.

In what was a quiet, rural setting only a few years ago, Arlington Cemetery and Fort Myer now find themselves surrounded and crowded in upon by Arlington County, a teeming, bustling metropolis of nearly 150,000 people. This "bedroom of Washington" suffers from all the acute problems of sudden and phenomenal growth.



George and Martha Washington Sample the Punch at 200-year-old Gadsby's Tavern

Once a year Alexandria's Little Theater revives the colonial theater, and a make-believe Colonel and Mistress Washington join the audience to watch a play that the Washingtons themselves might have seen. Details are exact, from lace ruffles to white wigs, but most authentic of all is the site, Gadsby's Tavern in Alexandria.

The older of two buildings which make up Gadsby's was built in 1751, the newer in 1791. There George Washington ate many a meal, danced many a minuet, and presumably watched plays by itinerant troupes.

Lantern boys meet guests in the courtyard, a white-wigged innkeeper greets them, and a pretty colonial maid shows them to seats. Programs in old-style type warn gentlemen that they "cannot possibly be admitted behind the Scenes." Little Theater members take turns playing George and Martha.



Union Troops Stand Guard Outside Robert E. Lee's Home, June, 1864

George Washington Parke Custis, adopted son of George Washington, erected Arlington House in 1803-17. Its portico was inspired by classic ruins in Europe. The mansion entertained Lafayette in 1824 and 1825. Later it became Lee's home for 30 years. Here in 1861 he decided to join the Confederacy, and when war began the Federal army occupied the home. The Lees never recovered it, but their son received \$150,000.

Arlington County is filling up with dramatic speed. Many of its residential areas are closer to downtown Washington than some of the District's own suburbs, and in it are located not only the Pentagon but several temporary Government office buildings housing thousands of military personnel for whom there is no room in the Pentagon.

Arlington County Has Growing Pains

Not only this vast army of Government workers but thousands of others who work in Washington itself try to find homes close at hand in the country. Naturally the impact on the county of trying to provide bridges, boulevards, streets, water, utilities, sewers, schools, parks, and other facilities is terrific. Arlington must do in a few years what other growing communities have taken 50 years or more to accomplish.

Curiously enough, Arlington County does not have a single incorporated city or even a town within its limits. Although a city in effect, it is not so in name or form, having only a county government, with a county manager.

The smallest of Virginia's 100 counties, Arlington has 6,250 persons to the square mile, as compared with several counties with 10 to the square mile. Its population has more than doubled in 10 years and multiplied nearly sixfold in 20 years.

I asked one of the older real estate developers of the county, now 86 years of age, to tell me something of his early life there. As a youthful, crusading newspaper editor, he had helped to drive out of the strip along the river a veritable nest of low dives, saloons, and gambling dens which had moved in some years after the Civil War, following the re-



Alexandria: Looking Down Historic King Street to George Washington Masonic Memorial

Colonial Alexandria was one of the country's busiest ports. Before 1800 merchants built stately brick homes on streets named Queen, Prince, Princess, and Duke. After the Civil War trade dwindled and old homes decayed. Many have been restored and prices have soared. Residents still use churches and houses known to General Washington. Today a few oil tankers, sand barges, and newsprint carriers ply the river front.

moval of Federal troops. For a time murders were an almost weekly occurrence.

"When I first went to Arlington," said my informant, "there were no modern roads, only dirt wagon trails. I had a horse, but when I went to Washington I usually sent him back because he was too slow, and I walked."

Building permits, barometer of a community's growth, soared in Arlington County from \$12,839,105 for 1940 to \$39,851,135 in 1951. During the war year 1944 the total fell off to \$4,158,041, but construction increased steadily as building materials became more plentiful.

Arlington County residents no longer need

journey to Washington to shop. Many busy shopping centers, with parking facilities, fill every need. One Washington department store spent \$15,000,000 to build a huge shopping center in Arlington. In addition to a branch of the main store, it includes 18 smaller stores and parking space for 2,000 cars (page 3).

Such projects have brought handsome returns to many owners of Arlington land. One was a retired Negro preacher, who lived in a shack on less than an acre needed for a new shopping center. He was paid \$25,000 for his land.

The most striking index of the growth of Arlington and of adjoining Alexandria, and



the most drastic change in the old rural Virginia setting, is the rise of great apartment cities, especially along the routes of the new arterial highways.

Most of the large developments are of the "garden" type, with many different buildings in a single development (page 30). They vary from unattractive structures on inadequate acreage to the most attractive architecture combined with all the spaciousness of arrangement that anyone could ask.

In the Metropolitan Life Insurance Company's Parkfairfax there are only nine families to the acre. Only one-tenth of the land is covered by buildings, and the structures are not identical but differ in heights and angles (pages 28-29).

Most of the great apartment developments take children, but dogs and other pets are far from welcome.

The largest apartment city in this area is Fairlington, which straddles the new Henry G. Shirley Memorial Highway. This development houses between 10,000 and 12,000 people in 579 large buildings. It took me quite a long time just to drive through Fairlington.

One of the first of the garden-type apartment developments in Arlington was Colonial Village, locally noted for its basement hobby shop, where tenants may use power tools and make or repair anything they wish. One tenant made all the furniture for his apartment (page 31).

Alexandria, Home Town of Washington

From the Pentagon and Arlington Cemetery it is only natural to turn to Alexandria; of all the cities of the country it is most closely identified with the first general of our armies, George Washington.

Early in 1952 Alexandria doubled its area through annexation of 7.6 square miles from Fairfax County. This increased the population from 61,787 to an estimated 75,000.

Proud, distinctive, self-assured, and independent, an important colonial seaport long before its half-century of inclusion in the Nation's Capital, Alexandria was described in 1797 by the Duc de la Rochefoucauld as "beyond all comparison the handsomest town in Virginia, and indeed among the finest in the United States." It still retains much of the appearance, charm, and atmosphere of another century.

Of the millions of Americans who visit the Capital each year, an increasing number make the pilgrimage to Mount Vernon, home of George Washington.* To reach it, they travel the main street of Alexandria, which has a peculiar claim on the interest and regard of every patriotic American.

It is here, directly on the route to Mount Vernon, or within the radius of a few short blocks, that George Washington comes to life; here he seems more real than anywhere else except at Mount Vernon itself.

Mount Vernon was his home, but Alexandria was his home town, in every sense of the word, from his boyhood until his death—a proud distinction for any city.

Washington grew up among Alexandria's first settlers; as a youth of 17 he helped survey its streets. He was a trustee of the town and a justice of its court. It was his voting place and market, and here he maintained a town house. He represented it in the House of Burgesses, and was an honorary member of one of its fire companies. He owned a pew in its established church, and was a stockholder and patron of its first local bank.

Washington drilled his first troops in the Market Square, part of which is still a farmers'

* See "Home of the First Farmer of America (Mount Vernon)," by Worth E. Shoults, NATIONAL GEOGRAPHIC MAGAZINE, May, 1928.



Freight Sorters Receive and Dispatch 80 Trains a Day in Potomac Yard

Alexandria's Potomac Yard is the main link between northern and southern railways in the eastern United States. Its 110 miles of track marshal trains bound north and south. Floodlights bathe the tracks for night work, and yard engines carry radios to receive orders.

In sorting, trains are pushed up a ramp and the cars uncoupled. As each car coasts down the other side, the sorter operates switches and track brakes from his control tower to assemble a new train.

✓ The ice plant in Potomac Yard can make 550 tons a day. Even that is not always enough to cool the 800,000 tons of fruits and vegetables that pass through yearly. These men push ice cakes into the bunkers of a refrigerator car.

National Geographic Photographer
Robert F. Sloman

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market behind the City Hall. He assumed his first military command in Alexandria, and here he held his last military review. Alexandria physicians ministered to his last wants, and local Masons conducted his funeral. For years he was known to all, high and low, as "the General," and he is so spoken of to this day.

So many places in old Alexandria are intimately associated with Washington that you come to feel as if it were only yesterday that he rode to town to sit in his pew at Christ Church or to attend a ball at Gadsby's Tavern (page 18).

History Still Lives in Alexandria

Events which are far away when measured by the flight of time are real and vivid enough when one is in the presence of ancient landmarks. Indeed, old Alexandrians still speak of the General's funeral as if they had just attended it.

Through family tradition Washington lives today in the hearts of many Alexandrians, some of whom are direct descendants of his brothers.

I met two of these descendants at the weekly luncheon of the Rotary Club, where I sat next to one who is a local practicing physician. I enjoyed a long visit after lunch with the other, a local real estate dealer.

Part of the Rotary program was to present to me, a visitor, copies of the wills of George and Martha Washington.

With giant military and other Government installations approaching ever closer and great apartment developments fairly ringing the city about, Alexandria is bound to change.

But I wish the reader would step into the town's old core, centering about Washington and King Streets and lying mostly between Washington Street and the river. Here he will find a world apart, on such streets as King, Queen, Prince, Princess, Duke, Lee, Fairfax, Royal, Pitt, and St. Asaph.

Hundreds of Old Houses Survive

In block after block, wherever you turn, there are so many fine old houses that individual mention is impossible. A few blocks are still paved with cobblestones, laid, so tradition has it, by Hessian soldiers after the Revolution.

As in several other Atlantic coast seaports, early home-building craftsmanship was extraordinarily skillful. A careful census shows that more than 450 Alexandria buildings, mostly residences, erected before 1830 are still standing (page 25).

A peculiar type of Alexandria house is the flat-backed "flounder," of two stories with half a gable roof. All these houses were set

well back from the street, with their long, windowless rear wall on the side lot line.

Some authorities say that the flounder was built as the first portion of a projected town house, which, for some reason, was never completed.

Others say the houses were designed to resist the cold north wind; the flat side usually faces in that direction. Still another theory is that the houses were built in this manner so that they might be subject to low taxes as "unfinished construction."

In any case, the name "flounder" seems to spring from the fact that the houses are "eyeless" on one side, like the flat fish.

As its surroundings grow more metropolitan, Alexandria can hardly keep its once quiet and unhurried pace. It has been said that "with it the South begins immediately." The old city still has a strong suggestion of an easy, pleasant, gracious way of living.

The statue of a Confederate soldier, facing the South and with his back to the North, still stands in the center of the city, in the midst of an ever-mounting stream of traffic.

Tradition means much and continuity has a strong hold. The *Alexandria Gazette* is the proud descendant of an 18th-century newspaper. Its views have been strongly southern, not only during the Civil War but in 1948 when it espoused the Dixiecrat cause.

Only four times has the *Gazette* gone into mourning, for General Washington, for Robert E. Lee, for the late C. C. Carlin, who bought the paper in 1911 and whose son now operates it, and for President Franklin D. Roosevelt.

Church of Two Great Americans

Near the center of the city is a historic landmark, Christ Church, its rear elevation facing directly on the Mount Vernon Memorial Highway, which in Alexandria follows Washington Street.

Here you may sit in the pews occupied by two of America's greatest generals, George Washington and Robert E. Lee. Washington paid 36 pounds 10 shillings for the pew now numbered 60, the highest price paid for any of the pews when the church was built. Later Lee occupied pew number 46.

As far as is known, services have been held continuously in the church since it was completed in 1773, and, unlike several other famous Virginia houses of worship, it never suffered the indignity of being left deserted and exposed to the elements (page 16).

George Washington's family Bible, used at Mount Vernon, belongs to the parish, but is kept in a bank vault and appears only on rare occasions.

For many years it was the custom for the President of the United States to attend Christ

Church on the Sunday nearest Washington's birthday and worship in Washington's pew.

Among Alexandria's early settlers were many Scottish merchants, one of whom, John Carlyle, built himself a fine mansion on the riverbank, and married into the wealthy and powerful Fairfax family.

In this house Gen. Edward Braddock made his headquarters before marching to his tragic defeat at Fort Duquesne (Pittsburgh).*

Staunchly built on the foundations of what is believed to have been an old fort, the Carlyle House remains intact and open to visitors. But its once lovely view of the river is no more, nor can it be seen from the town side, since it is not only hidden but practically enclosed by a ring of buildings. Entrance is through an adjoining apartment building.

Facing Carlyle House across old Market Square is Gadsby's Tavern, one of 34 inns which flourished during Alexandria's greatness as a seaport. In its time it offered the ultimate in comfort and elegance, and was among the most famous of all colonial, revolutionary, or post-revolutionary taverns (page 18).

Alexandria is of especial interest to members of the Masonic Fraternity, not only because George Washington was the first Master of Alexandria-Washington Lodge No. 22, but because of the colossal George Washington Masonic National Memorial, which is nearing completion on a hill a mile west of the old town of Alexandria (pages 20 and 32).

Some 3,500,000 Masons have contributed to the erection of the huge memorial, the exterior of which is practically complete. It stands on Shooters Hill, which was once considered as a site for the Nation's Capital.

Clock Marks Washington's Death

The memorial is 333 feet high. Stark, bold, and massive, it is conspicuous to the traveler no matter from what direction he approaches Alexandria.

It contains a replica of the first permanent home of the Alexandria lodge, with many valuable Washington relics and paintings. One of the most interesting of these is the William Williams portrait of Washington, a very different conception from most of his portraits. It was commissioned by the Alexandria lodge, who told the artist, "Paint him as he is." It is less flattering than many likenesses, and brings out facial blemishes shown in modified form, if at all, by other artists.

Among the many relics is Washington's bedchamber clock, which Dr. Elisha C. Dick, one of the attending physicians, stopped at the moment of death, 10:20 p. m., where its hands remain today. Here also are the Masonic apron and trowel Washington used to lay the cornerstone of the Capitol in 1793.†

A larger room occupied by Lodge 22 contains an Oriental rug, presented to the memorial in 1948 by Brother Sarkis H. Nahigian. The donor believed the rug to be the largest of its kind in the world; he valued it at more than a million dollars. It displays unexpected qualities of color under artificial light. Mr. Nahigian came to this country as a youth. The rug was given in appreciation of the opportunities he had found in his adopted land.

The memorial is open to all visitors, whether Masons or not. The great entrance hall is the Washington memorial room; there are a large auditorium of Greek amphitheater style, dining room, and Shrine museum rooms with dioramas of crippled children's hospitals.

Elevators Run on a Slant

Because of the building's structural peculiarities, the two elevators will travel up slanting shafts, $7\frac{1}{2}$ degrees off center, with the two shafts approaching one another very closely at the top floor. These will be the only high-speed elevators operating on an angle known to exist in the world; the Eiffel Tower elevators in Paris operate on an angle but at slow speed.

Since many of Alexandria's founders were Scottish merchants, it is only natural that one of the city's oldest buildings is the Presbyterian Meeting House, beautiful in its functional simplicity.

Many of Washington's friends, associates, and pallbearers are buried here. More than a century ago the remains of a Revolutionary soldier, buried in an ammunition box, were found in the yard, probably the first of the unknown soldiers of all our wars. The inscription on his monument, erected 103 years after the body was found, refers to him as a soldier "known but to God."

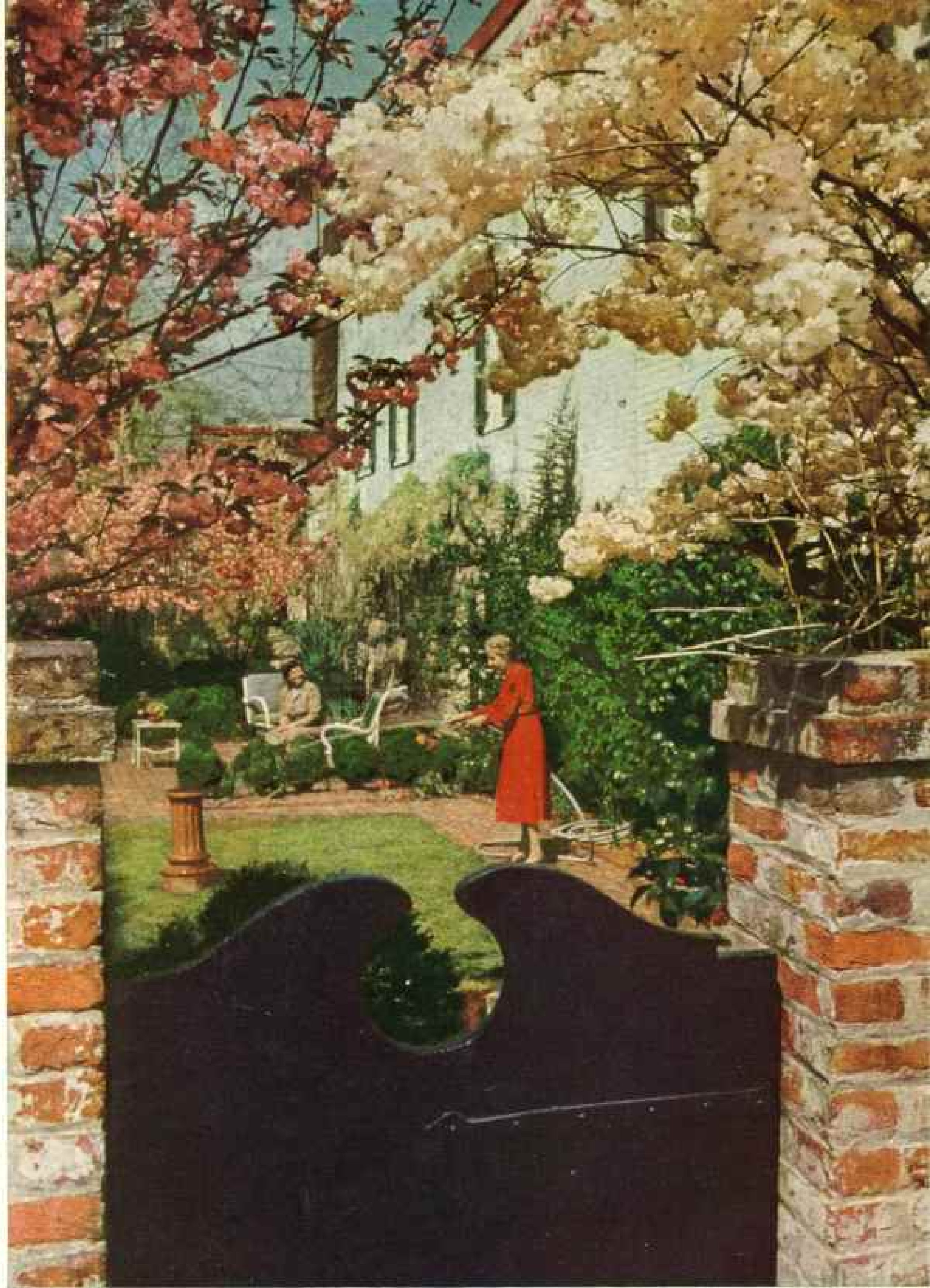
Alexandria was the home town not only of General Washington but of that great hero and symbol of the South, Robert E. Lee. For a time Lee attended Alexandria Academy, of which General Washington had been a trustee and to which he was a generous donor.

Later young Lee was prepared for West Point by a Quaker, Benjamin Hallowell, who conducted a school next door to the home of the boy and his widowed mother, 607 Oronoco Street.

Lee's father, the Revolutionary hero Gen. Henry (Light Horse Harry) Lee, had previously lived a few blocks away at 611 Cameron Street.

* See "The Travels of George Washington," by William Joseph Showalter, NATIONAL GEOGRAPHIC MAGAZINE, January, 1932.

† See "U. S. Capitol, Citadel of Democracy," by Lonelle Aikman, NATIONAL GEOGRAPHIC MAGAZINE, August, 1952.



Oriental Flowering Cherry Trees Arch the Garden Gate of a 200-year-old Alexandria House
 Number 113 South Lee Street is thought to have been built by Lawrence Washington, George's half brother, about 1750. Present tenants are New Jersey's Representative James C. Auchincloss and his wife (holding hose).



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Produced by National Geographic Photographer B. Anthony Bonetti

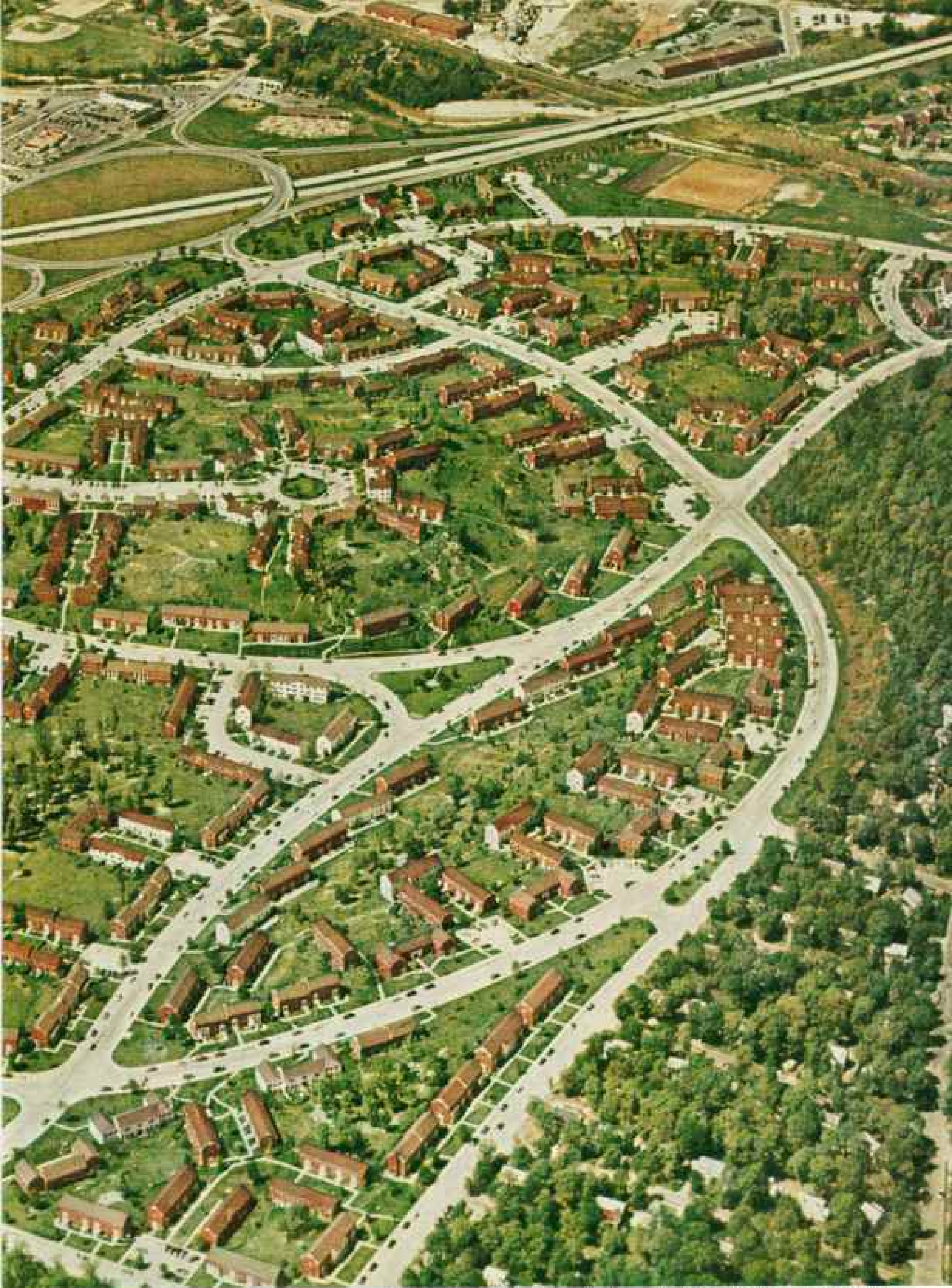
Racing Sailboats Cross the Finish Line in Washington Sailing Marina. Airport Tower and Washington Monument Crowd the Skyline
This inlet indents the mile-wide Potomac. Boat owners rent pier space from Government Services, Inc. Opposite: Washington National Airport's main terminal, one of the world's busiest, handles 2,500,000 passengers a year.





Two Enormous Apartment Cities Hold 15,000 Virginians, Many of Them Newcomers

Dual-lane Shirley Highway divides Alexandria's Parkfairfax from Arlington's Shirlington Business Center (top). A bit of Fairlington, Arlington's biggest garden apartment development, occupies the triangle on the left.



An Air View Reveals the Complex of Streets Serving Parkfairfax's 1,681 Families

Construction engineers a decade ago found only woods and a stream. Now Parkfairfax has 285 buildings. Tenants enjoy trees, lawns, and parking space. Metropolitan Life Insurance Company is the owner.





More Space and Lower Rents Lure Washingtonians to Arlington. Lee Gardens Children Frolic in Sun and Water

✦ Tenants of Colonial Village Apartments, Arlington, repair everything from chairs to banjo clock in their basement hobby shop.

Photodrama by National Geographic Photographer H. Arthur Stewart





It was Gen. Henry Lee who first used the now famous phrase in regard to Washington, "first in war, first in peace, and first in the hearts of his countrymen."

The two Lee houses and the Hallowell School are close to Christ Church, and all three houses are in a good state of preservation. Almost across the street from the home of the youthful Lee is the present home of John L. Lewis, head of the United Mine Workers.

The Boy Who Made the Eagle Scream

Almost every old building in Alexandria has its story. A local historian pointed out one such structure near the city's main intersection, and told me:

"Up in that window, when Lafayette visited Alexandria, a small boy had a job which should have been the envy of every other boy. A triumphal arch stood at the intersection, and on top of it was fastened a live eagle. A chain extended from the eagle's leg to the boy in the window, and as Lafayette passed under the arch the boy pulled the chain to make the eagle scream."

One of the most appealing of Alexandria's legends is that of the Female Stranger. Unfortunately, the only known facts are those in a long and touching epitaph in St. Paul's Episcopal Church burying ground at the end of Wilkes Street. It starts with the words, "To the Memory of a Female Stranger," and it goes on to relate that her "mortal suffering terminated" October 14, 1816, aged 23 years and 8 months, and that the tomb was erected by her disconsolate husband.

From here on, unsupported tradition takes over. One version has it that she was of royal birth, had married a commoner, and, heavily veiled and accompanied by her husband, landed from a ship, went to Gadsby's Tavern, and died several weeks later.

Alexandria was once a world port, but the railroads put an end to most of this phase of its existence.

From the river the view of the rotting wharves, once so busy with the tobacco and later the wheat trade, is picturesque, even if pathetic.

By far the most interesting ocean-going

ships which still visit Alexandria are those from mainland Canada and Nova Scotia and Newfoundland, Finland, and Sweden laden with newsprint for the Washington newspapers.

But Alexandria today is one of the great transportation centers of the Nation, despite the decline of Potomac River shipping. Here daily hundreds of cars of fresh vegetables and fruit, destined to feed New York and other large coastal cities, are "classified," or rerouted, and serviced on their railroad trip north from the Southeastern States (page 22).

The yards are owned by the Richmond, Fredericksburg, and Potomac Railroad, which operates the only direct railroad between Washington and Richmond. Though it carries the trains of other lines over its tracks, it is the main railroad artery, the highly strategic link between North and South along the Coastal Plain.

This short railroad is controlled by six main railroad systems, although the State of Virginia has a substantial interest. Virginia invested \$275,000 in the company in 1835 and has received \$6,000,000 in cash dividends and \$1,500,000 in stock dividends.

Despite intense highway competition, the company's transportation of freight and passengers has increased substantially. It carried 9½ million tons of freight in 1951.

The Vanishing Wilderness

Three miles northwest of downtown Alexandria, on a high ridge in a 65-acre tract of beautiful oak trees, is the Protestant Episcopal Theological Seminary in Virginia, for a century and a quarter a powerful influence in the life of that church.

Ten years ago it was literally in the country, and at an earlier date it was referred to as in "the wilderness." One of the older faculty houses is still known as "the Wilderness." Now it is almost completely surrounded by shopping centers and great apartment cities. In fact, nearly half the student body, the married ones, live in near-by Parkfairfax.

The students themselves are the most interesting thing about the "Hill," as it is familiarly known. Their average age is 27, but they range up to 56; several have married children, and one has grandchildren. Among the students are former stockbrokers, lawyers, undertakers, carpenters, ranchers, and musicians. One flew 30 missions over Germany in World War II, and others served in the Pacific.

The hill is a stabilizing force, with new people and new developments revolving around it like a kaleidoscope.

This and other oases still exist across the Potomac from Washington, but daily they become harder to find as the world's most important capital overflows into near-by Virginia.

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Photographers Willard R. Culver and Donald McElain

← Bronze, Six-ton George Washington Wears Masonic Sash and Apron

Washington, a Master Mason, wore such an apron when he laid the cornerstone of the National Capitol. His statue, unveiled in 1950, stands in the 333-foot-high Masonic memorial erected to him in Alexandria. C. Philip Heishley (left) is secretary of the Alexandria-Washington Lodge No. 22, Ancient Free and Accepted Masons. "People often shake my hand," he reports, "thinking I am Harry S. Truman."



A Trinidad Calypso Dancer Performs with Expressive Gestures and Primitive Rhythms

Slaves of an earlier day were encouraged to make up ballads for their own entertainment. From this custom grew calypso folk songs lampooning important persons and current affairs (pages 64, 65).

Britain's Caribbean Colony, Busy Source of Oil, Sugar, and Cacao, Finds Time for Calypsoes and Cricket

BY CHARLES ALLMON

With Illustrations from Photographs by the Author

"HEAVEN knows where my husband is or what he's doing!" said my English friend, grimacing in mock despair. "He puts on a mask and simply disappears for two days!"

It was Carnival time, just before Lent, when the British Colony of Trinidad and Tobago fills the tropic air with the sound of revelry.

In the streets of Port of Spain marchers cavorted in outlandish costumes, some representing the wearers' wages for a month (page 60). Calypso artists, singly and in trios and quartets, proudly sang new ballads specially composed for the occasion.

Everywhere sounded the clatter of steel bands, a form of music characteristic of rhythm-loving Trinidad.

Lost somewhere in the gay, noisy confusion was my friend's husband, who on most days of the year leads the sedate, industrious life of a colonial businessman.

"Ah, well," my friend said philosophically, "he will come home safely."

A Hard-working Colony

Such occasions represent the lighter side of life on Trinidad and its tiny satellite Tobago. To see such festivals as well as the industry, agriculture, home life, and natural beauties of the two Caribbean islands, I recently traveled their length and breadth in a small English-built Austin (map, page 39).

Three months' and 5,000 miles of touring gave me a new appreciation of how hard this Colony works to help supply the world with oil, sugar, cacao, asphalt, and other commodities. And here I also found such marvels as whistling frogs, French-speaking birds, and oysters that grow on trees.

My reason for coming was simple. In 1945 I had caught a glimpse of Trinidad and Tobago when we stopped to refuel on a flight from South America, and I had not been content until I could return for a thorough look.

Soon after my arrival a member of the Light Aeroplane Club of Trinidad and Tobago took me aloft for a bird's-eye view of Trinidad. Roughly rectangular, it is 50 miles north-south, 37 miles east-west, with broad arms reaching out 10 miles from the northwest corner and 30 miles in the southwest. Between these arms is the Gulf of Paria.

The central plain, a well-watered green car-

pet, slid beneath us; the Northern Range of mountains piled up to 3,000 feet on one side of the island, while on the southeast coast, just off our wingtip, I looked down on Trinity Hills. These had partly inspired Columbus to name the island "Trinidad" when he discovered it, July 31, 1498, on his third voyage.

Of gold he found no sign, nor did he receive a warm welcome from the unsociable Indians, who called the island Iere, "Land of the Hummingbird." Nevertheless, Columbus evidently thought well of it, for in a letter he compared it to Valencia in Spain.

Raleigh Bids for Possession

Two Englishmen, Robert Dudley and Sir Walter Raleigh, made brief bids for possession of Trinidad in 1595. Despite these and other encroachments, notably Dutch raids in 1640 and French attacks in 1670 and 1690, the Spaniards maintained a tenuous political hold on the island for almost three centuries.

Spanish rule ended with Governor José María de Chacón's surrender without a fight to Sir Ralph Abercromby on February 18, 1797. Abercromby's aide-de-camp, Sir Thomas Picton, was appointed the first English governor. Eventually the name of the capital was changed from Puerto de España to Port of Spain. Ruins of four old forts still stand in and around Port of Spain to recall its tumultuous past.

Today business establishments on Port of Spain's main thoroughfare, Frederick Street, indicate the varied national backgrounds of Trinidad's inhabitants. Alfonso B. de Lima's jewelry shop, Wing Sing's restaurant, W. C. Ross's drugstore, De Verteuil's Hat Shoppe, and B. I. Lalsingh, dry goods merchant, all compete for the British West Indian dollar, at present the only legal tender.

These diverse foreign strains have displaced the aboriginal inhabitants, practically all of whom have long since been destroyed or assimilated. Of the European elements, the Spaniards and English arrived in the island's early years, while French and Portuguese followed during the late 18th century, some as political refugees. Successive revolutions in Venezuela on the neighboring mainland also sent a steady stream of refugees to the island.

When Chacón was sent to Trinidad as Spanish governor in 1783, he found about 126

Spanish, British, and French settlers. Madrid encouraged foreigners of all nations to settle there, and by 1797 the population had risen to 17,712.

Negroes, introduced into Trinidad in the 18th century as slaves, have become the largest group in the polyglot population of 656,300 for both islands. They now engage in numerous occupations, and many have qualified for local government posts. White-helmeted Negro policemen direct traffic at intersections.

When slavery was abolished in 1834, plantation owners turned to contract-indentured Chinese and East Indians to fill gaps in the island's labor force. The first East Indian immigration ship arrived in 1845; the last in 1917. Today nearly 235,000 Hindus, Moslems, and other sects live in Trinidad and Tobago (pages 38, 56, 66, 67). They are exceeded in numbers only by the Negroes.

Shoes Removed to Visit Mosque

For the most part, these Orientals still practice their religion. I visited a mosque, first removing my shoes as custom dictates. As I padded down a passageway in stocking feet, I observed that the Moslems washed their hands, arms, feet, face, nostrils, ears, and inside of their mouths before entering the prayer room. In this room, walled and floored with green and white tile, three worshippers knelt on prayer rugs.

Indian movie studios find good markets in Trinidad. American films are also popular as well as English ones. This was the program at the local cinema the night I went: 8:30, English newsreel; 8:40, American newsreel; 8:50, Donald Duck; 9:00, intermission, with advertising slides; 9:15, Cary Grant feature; 10:45, the British national anthem.

Other popular diversions are athletics and horse racing, the latter centering at the track in Port of Spain's 199-acre Queen's Park, or Savannah.

Every Saturday and Sunday, and almost every evening, playing fields within the Savannah are alive with athletic events. Cricket, soccer, rugby, and many lawn games give the younger set an outlet for their energies.

Cricket is the national sport and the strongest single bond uniting all classes on the island. In 1950 Trinidad contributed six players to the West Indies team which defeated England.

The day the test match was won I happened to be ambling down Frederick Street. I met an acquaintance, whose first words were, "Wickets falling like fire!"

Together we rushed to the corner of Frederick and Queen Streets. A crowd of about 600 had gathered there. All necks craned toward a scoreboard on the roof of a corner

building. No one paid attention to the traffic jam rapidly forming.

As a boy in a bright sports shirt said, "Dat is confusion-fahder" (that is, the father of all confusions).

When the victory was sure, the crowd jumped, danced, sang, shouted, laughed. A general holiday was proclaimed.

The hero was 21-year-old K. T. (Sonny) Ramadhin, an East Indian orphan who in two years bowled his way to the pinnacle of cricket achievement at Lord's in London.

The athletic field where Ramadhin and his friends played cricket as boys was just a stretch of asphalt road. Boys play the same game today in Ramadhin's native village of Esperanza, often with a lime or an orange for a ball, and a coconut-stem bat.

In 1948 Clarence Skinner, a cricket enthusiast and refinery engineer, noticed Ramadhin. Something in the bowler's delivery made him stop. He made inquiries, and it was not long before he had found the bowler a job in the refinery. This gave Ramadhin proper opportunities to develop, and in 1950 he was selected as a member of the West Indies team.

His selection is an honor difficult to comprehend by those unfamiliar with a game so rich in history and opportunity for specialized skill. This great team, its victories due in no small measure to Ramadhin's masterful bowling, was later received by King George.

A Stroll in the Botanic Gardens

Near the Savannah are the attractive Royal Botanic Gardens, more than a century old. In a morning stroll through them I breathed perfumes not only from flowers and freshly cut grass but from crushed leaves of bay, camphor, and eucalyptus. I saw Egyptian lotus lilies, the sacred fig tree of the Buddhists, and a cable vine growing through the trunk of a tree.

I also saw numerous species of palms, the Ceylon willow, the monkeypot, and the fabulous double coconut, or coco de mer, which produces the world's biggest known seed, sometimes weighing 45 to 50 pounds.

Here too I encountered one of those curiosities I only half believed when I set out to explore Trinidad—"French-speaking birds." Kiskadees, attractive yellow and brown Derby flycatchers, flitted about the gardens. "*Qu'est-ce qu'il dit? Qu'est-ce qu'il dit?*" (What's he saying? What's he saying?) they seemed to ask.

In Port of Spain's old Spanish quarter is the factory where Angostura Bitters are made. This cocktail ingredient is produced only in Trinidad. Alfredo G. Siegert told me how his grandfather, a surgeon in Simón Bolívar's forces, developed a blend of aromatic and



Automobiles Clog Frederick Street, Traffic Goes One Way, the Woman Cyclist Another
Port of Spain's population exceeds 100,000. Latin, Oriental, African, and Anglo-Saxon mingle on its streets. These
rails are idle, buses having replaced trolleys. The distant tower marks the port's old lighthouse.



38

A Port of Spain Bazaar Offers Brassware from India

Trinidad's large East Indian population gives much of the island an Oriental atmosphere (pages 36, 56, 66, 67). Small shops offer Indian-style curries, sweetmeats, and silver ornaments. Large bazaars import textiles, rugs, and brassware from India. This girl wears a sari.

tonic bitters as a medicinal remedy (p. 58).

The "remedy" became so popular that a manufacturing business developed and is carried on today by Siegert and his son, who jealously guard the secret formula. Angostura was the old name of Ciudad Bolívar, Venezuela, original headquarters of the firm.

I roamed the length of Port of Spain's docks. Only six ocean-going ships can be accommodated in the single long continuous wharf; I saw nine queuing in the stream for berth space. Soon the port hopes to have three more berths. Vessels in the 30,000-ton

class anchor a mile or more offshore.

Many ships bring textiles from the United Kingdom or canned goods from Canada and Australia. Others deposit or pick up cargoes in transit to other ports. I saw automobiles destined for South America, manufactured goods from the Orient. Stevedores loaded bananas on an American ship bound for Mobile; bags of cacao and raw coffee went aboard a ship from Liverpool. In 1951, 5,213 ships, including sailing vessels, cleared the Colony's ports. In 1713 the whole trade of Trinidad was carried in a single vessel of 150 tons.

Sailing Craft Used

Coasting schooners carry much of the inter-island trade. Ten to 20 of these craft can usually be seen along the schooner jetty. I watched a 70-foot schooner bring in a cargo of livestock from Tobago. From Dominica came handicrafts and woven baskets. Other schooners had come from Barbados, Martinique, Antigua, and St. Kitts.

Many of these craft depended entirely upon sail. One of them once drifted within sight of Trinidad for 11 days in a calm, lacking sufficient wind to get through the Dragon's Mouths into the Gulf of Paria.

Driving west from Port of Spain, I stopped at the Aluminum Company of America's new bauxite transfer station at Point Tembladora (page 51).

"Our mines are located at Paranam and Moengo in Surinam," the superintendent explained. "Because of coastal shoals, the bauxite must be car-

ried by small vessels (or ocean-going freighters lightly loaded) and barges to Trinidad, where it is transferred to the storage tanks at Tembladora." There are 15 such tanks.

Buckets from a traveling crane scooped up tons of ore in a single bite from a shuttle ship lying alongside the 680-foot pier. The bauxite would go to a United States Gulf port to be refined into alumina and later to become pig aluminum at a reduction plant.

The Aluminum Company of Canada has its huge transshipment station at Chaguaramas. A large area in the northwest corner of

huts squat on the valley floor, and an occasional dwelling clings precariously to the vertical mountainside.

The beach at Maracas Bay is as yet untouched by commercialism, even though its access from Port of Spain is by the famed "skyline highway," or North Coast Road. American Seabees built the road during World War II in compensation for the fact that the American leased areas included some of the Colony's finest beaches (page 62).

Tall palms line the beach from the high-water mark, and their stems provide makeshift cricket bats for week-enders from Port of Spain. The balls for these impromptu beach games are "sea coconuts" from the moriche palm which drift over from Venezuela.

In another valley, Santa Cruz, I encountered the island's third most important industry, the culture of "cocoa" (page 71). After a period of decline between wars, the cocoa industry was revitalized by high postwar prices and is now prospering. An important Trinidad institution, the Imperial College of Tropical Agriculture at St. Augustine, has as one of its many activities the development of new and improved types of cacao trees. Other projects carried on by the college have paid dividends all over the Tropics.

Fishing Fleet at Work

At Sans Souci I watched native fishermen loading 18-foot boats in preparation for a day's work. About 40 boats, each privately owned, operate as a fleet. I was told a good day's catch might be around 7,000 pounds for all boats. Kingfish up to 15 or 20 pounds are caught on lines of copper wire. Sardines are used for bait.

Why Worry, *Trust in God*, and *Tokyo Rose* were among the boat names.

At Toco, near the northeast tip of Trinidad, I stayed overnight in a guest house. Outside, small night frogs struck up a whistling anvil chorus, a few hitting notes worthy of a fledgling flutist. So—there are whistling frogs!

Many of the valleys in the north coast range of mountains are sparsely inhabited. When I reached Arima, a town of 9,000, I felt I had arrived at an urban center. Formerly a populous aboriginal Indian settlement, it is now the Colony's third town. Traces of the Caribs are hard to find, but their legends figure prominently in the Santa Rosa fete held here annually at the end of August.

Driving through the dense tropical forest near Sangre Grande, I passed trucks and bullock carts carrying bags of charcoal made from various trees. North of Sangre Grande I also noticed *Hevea* rubber trees.

Emerging onto the east coast near Cocos Bay, I was welcomed by a signpost in the

sand indicating that at low tide the beach itself is to be used as the main thoroughfare. I was delighted to speed along at 55 miles per hour.

A self-service barge hauled my car across the small stream at Nariva Ferry, superseded last year by a bridge. Mangrove trees cling to the banks of this stream, and I stooped to pick a few oysters growing on branches which dropped into the water.

Mayaro Bay, like Cocos Bay, is enclosed by a broad ribbon of sand, some 12 miles long, with coconut palms indicating high-water mark. At Rio Claro I wandered about the streets admiring open-air displays of merchandise ranging from bolts of cloth to hairpins and Coca-Cola.

Government Cultivates Teak

Moving on through the Central Range toward Tabaquite, I stopped to look over the Government's teak-planting project. Several thousand acres of bush were being cleared and will be planted to insure a future supply of valuable wood for the Colony. I was told that from mid-January to mid-March great stands of bois immortelle, a tall shade tree, are ablaze with orange-red blooms along this road.

At a Hindu temple near Las Lomas I enjoyed an unusual visit with the priest Doon Pundit, awarded the Member of the British Empire decoration in 1949 for his outstanding social services to East Indians of Trinidad (page 67). Immediately after our introduction, he asked how old I was and whether I was married.

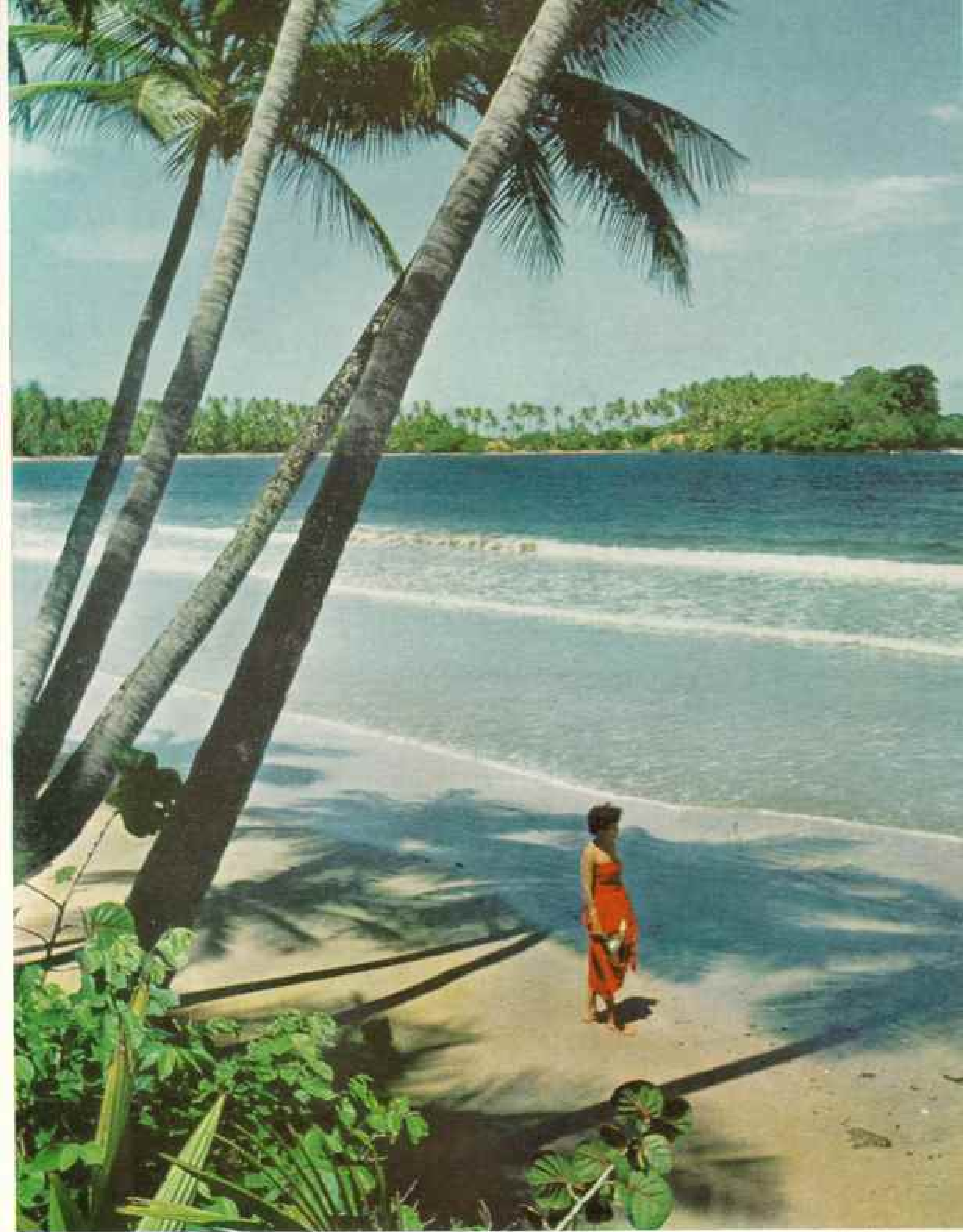
Not to be outdone, I asked a few questions of my own. I wound up learning, among other things, how a Hindu wraps his turban.

Doon Pundit conducted me through the Pullman-sized temple, explaining that the figures painted on the white walls were various gods and their wives. Outside the temple red, yellow, and white flags, representing Hindu saints, fluttered at the ends of 40-foot poles. Later tea was served, and I found my thoughts preoccupied with this alien race arbitrarily cast up on a Caribbean shore.

Rice Grows on 20,000 Acres

One day I took the American-built Churchill-Roosevelt Highway southeast from the outskirts of Port of Spain, then the Caroni Savannah Road south to San Fernando. The great sweeping plain here forms the heart of Trinidad's agricultural empire.

In wide fields of water on either side of the road, East Indians waded knee-deep in rice fields. Some 20,000 acres are utilized for rice growing. Bullocks are most frequently used in cultivation, but I also saw burros pulling drags about the paddies (pages 46, 47).



Paradise of the Caribbees: Surf and Coconuts Meet on Trinidad's Inviting Shores

Columbus, approaching a Caribbean island in 1498, saw three closely grouped summits looming above the horizon. Fulfilling a vow, he christened his discovery "Trinidad" in honor of the Trinity. The island still bears that name; the peaks are now called Trinity Hills. To winter-weary northern folk, Trinidad offers dazzling white beaches, unbelievably blue seas, and shimmering tropical colors like those of Venezuela, only a few miles distant.

This fine beach along Sena Bay, here deserted except for a Portuguese girl from Port of Spain, receives crowds of pleasure seekers on week ends. Not far away, automobiles speed at 50 miles an hour on the long, firm beaches of Cocos and Mayaro Bays.



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Head Baskets, Heavily Laden but Delicately Poised, Free West Indian Hands for Other Uses

Negroes form the largest single group on both Trinidad and Tobago. These women, following West Indian custom, carry 25- to 40-pound loads on their heads. So balanced is their carriage that baskets never fall. Breadfruit and citrus occupy hands of the shopper in center. A few older women still cherish pipes (left).

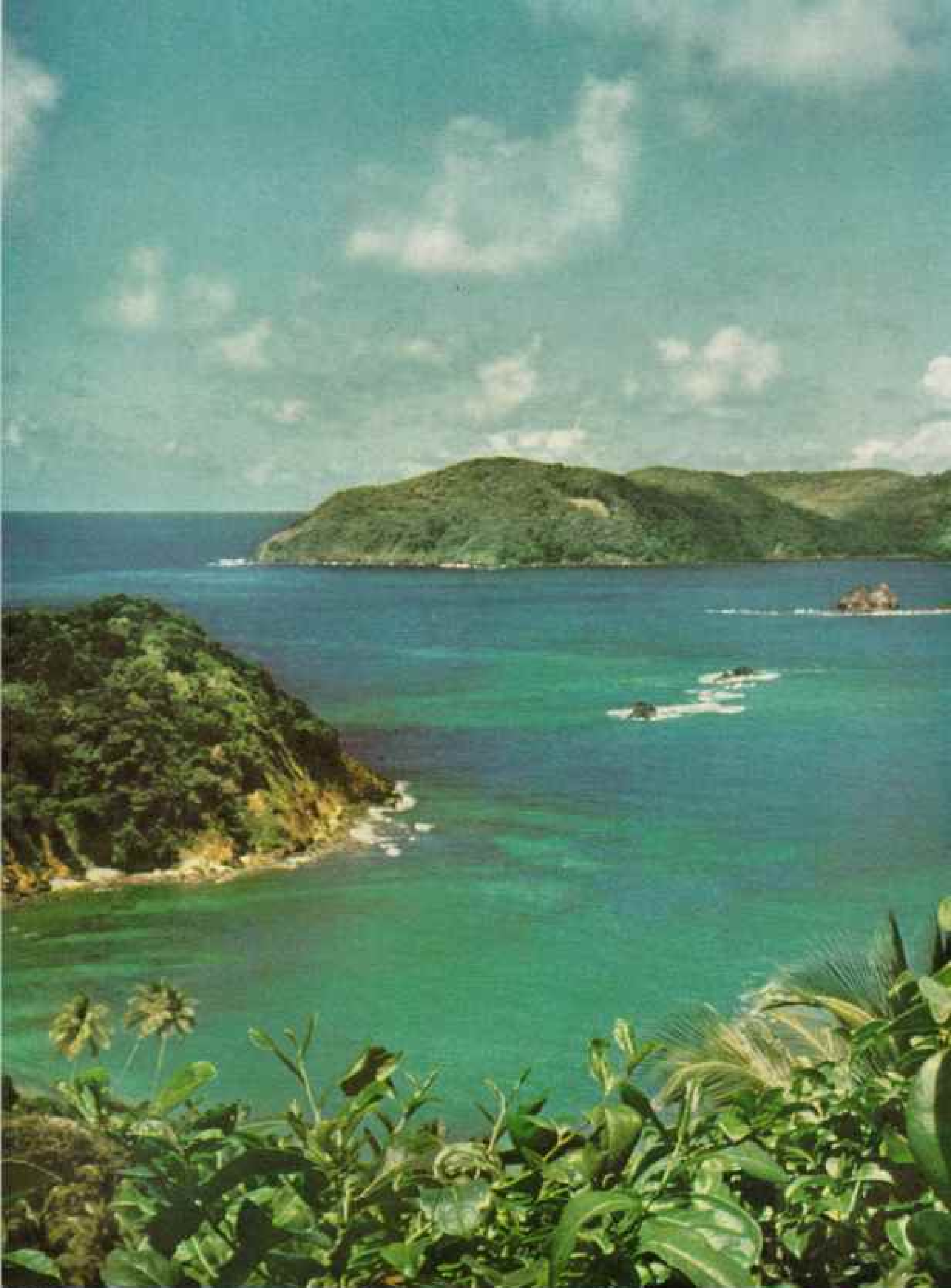
Steel Drums, Homemade from Oil Barrels, Fill the Air with Clangor

Trinidad at Carnival time throbs with primitive rhythms as the steel bands, gaudily costumed and vying for attention, parade through the streets. Musicians make their instruments by denting and tempering sections on the tops of oil drums. Each section gives a different note when beaten with rubber-tipped sticks.

Kodachromes by Charles Allen

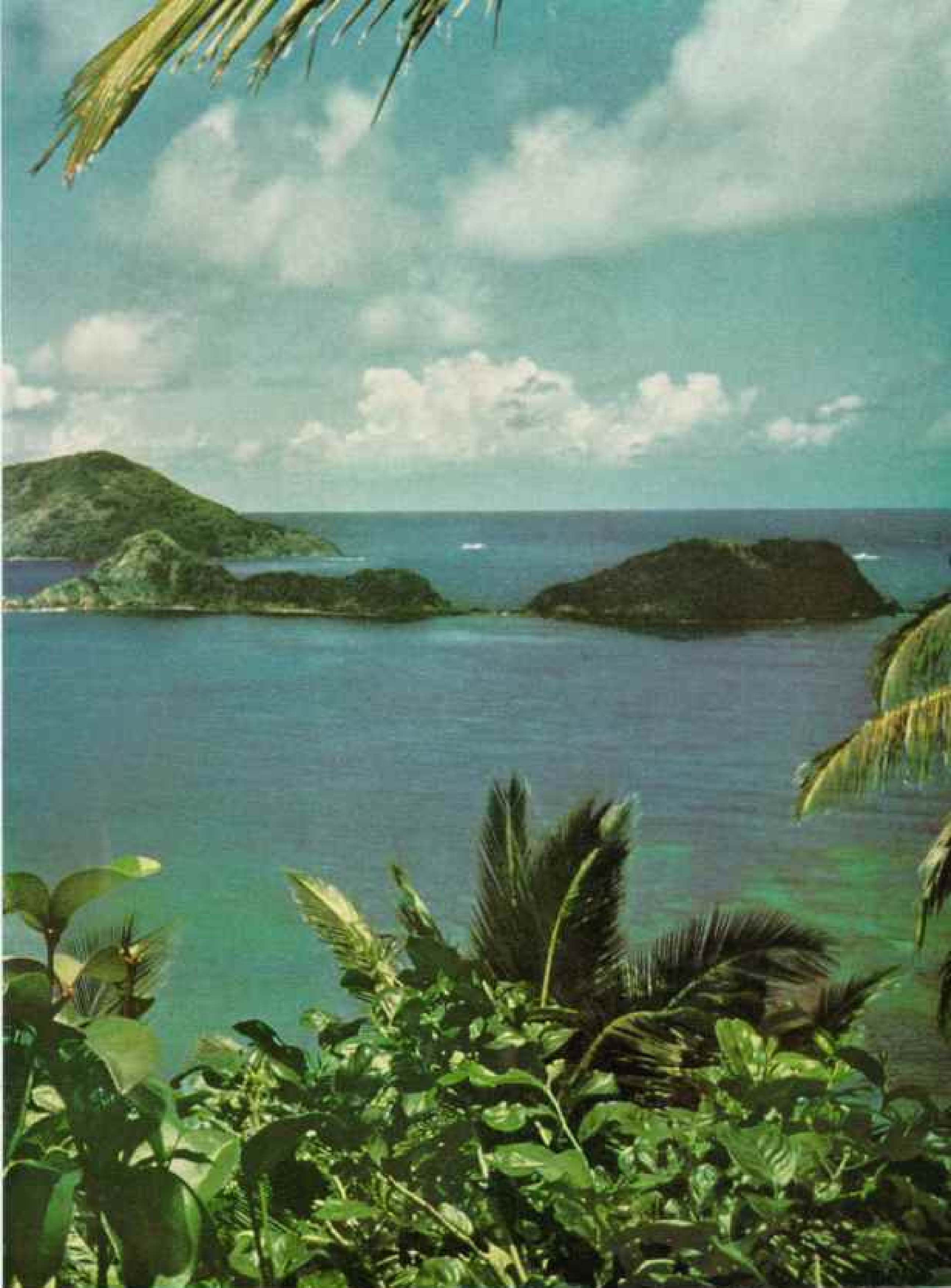
43





Little Tobago's Jungled Slopes Give Strange Sanctuary to Rare Birds from New Guinea

Sir William Ingram in 1909 transplanted yellow-plumed greater birds of paradise to the island in the background. The Government, having planted fruit trees for the birds, now sends fresh water to them once a week.



Big Tobago Is a Botanists' Delight; Lacy Greenery Rims Its Shores

Waters of the Orinoco River, flowing out of near-by Venezuela, wash the beaches of Trinidad and its satellites. Floods strew the shores with nuts, logs, and other debris.



↑ Humped Cattle Plow Sodden Rice Fields

Distant mountains, rising 3,000 feet, form Trinidad's northern backbone. Their jungle cover, the "high woods," is all but impenetrable. Crops in the central plain grow abundantly, and rice acreage increases yearly.

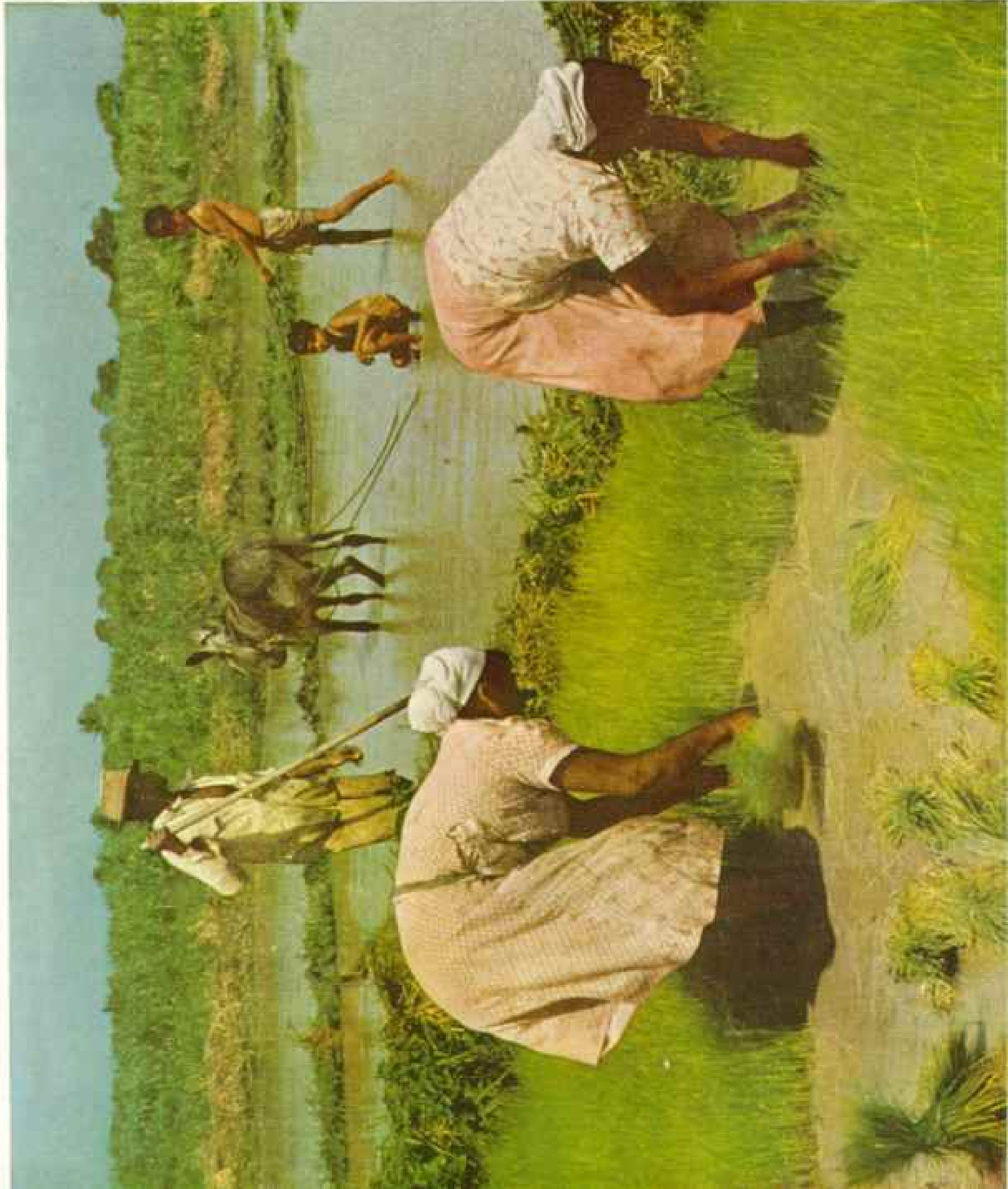
Flooded fields and backbreaking work mark rice culture in Trinidad, as in the Orient. Zebu, such as these oxen came from India, as did their kindred, the Brahman cattle of the United States Gulf coast.

← Each Tiny Seedling Must Be Set by Hand

East Indians (page 56) raise most of Trinidad's rice, cultivating some 20,000 acres. Planting time comes in midsummer, when heavy rains flood the dammed-up fields. The main crop is harvested late in the year. A second growth, coming up voluntarily from the roots, may be reaped in February.

Here a workman and his sons drive their donkey up and down the flooded plot, smoothing the soil before planting. Smallest member of the family enjoys a free ride while serving as ballast for the drag. Women uproot rice shoots from a seedbed for transplanting. Many backs must ache before this work is done.

Reproduction by Charles Adams



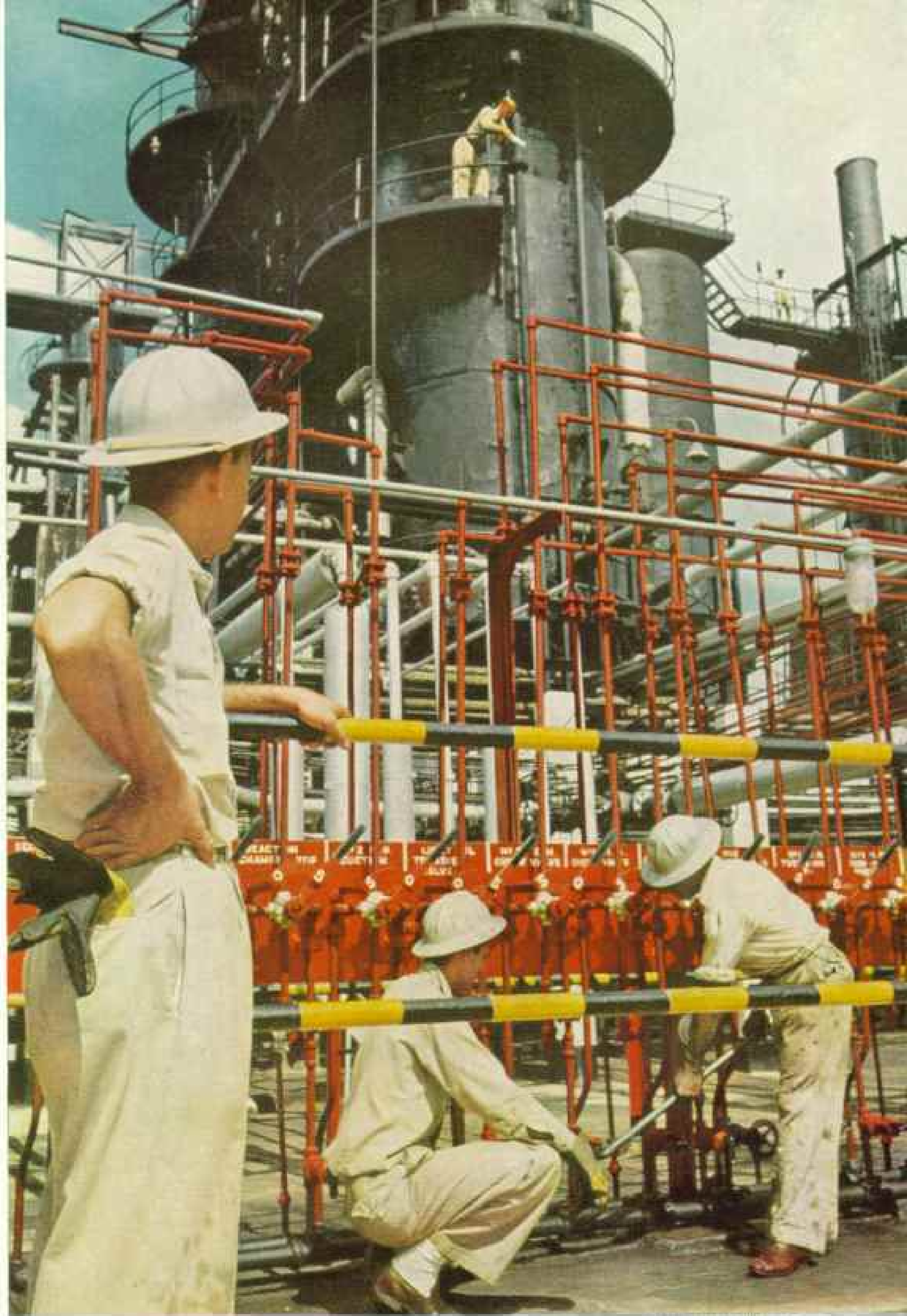


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Drillers Work to Expand the Flow from Trinidad's Oil Fields

Until Canada and Brunei, Borneo, nosed ahead after World War II, Trinidad was the British Commonwealth's chief oil producer. Here members of a drilling crew adjust and grease a swivel. The derrick rises 120 feet.



Pointe à Pierre Refinery: Steel-hatted Workmen Check a Labyrinth of Pipes

Quick work here can stop fire at any point in the plant. An emergency control panel (foreground) shuts off flow of aviation gasoline and other inflammables. These men adjust controls.

A Mushroom Farm of Silver Tanks Holds Trinidad's Black Gold

During World War I the British Navy, recently converted from coal, turned the searchlight on Trinidad for fuel oil. Today oil bulwarks the Colony's economic life, providing four-fifths of its exports and two-fifths of its revenues in 1951.

Oil has not always been easy to find. The difficulties are told in the history of nearly 150 defunct petroleum companies; only 11 remain active.

More than 2,000 wells pour out Trinidad's liquid wealth, yet additional oil must be imported from Venezuela, Colombia, and the Near East to supply the island's tremendous refining capacity.

Here, at Pointe à Pierre, stands Trinidad's largest tank farm and one of the British Commonwealth's largest refineries, the property of Trinidad Leaseholds, Ltd. It is one reason Trinidad exported \$165,700,000 in petroleum products in 1951.

Distant Naparima Hill is a familiar landmark in San Fernando. At left, seed pods hang from a flamboyant tree in full flower.

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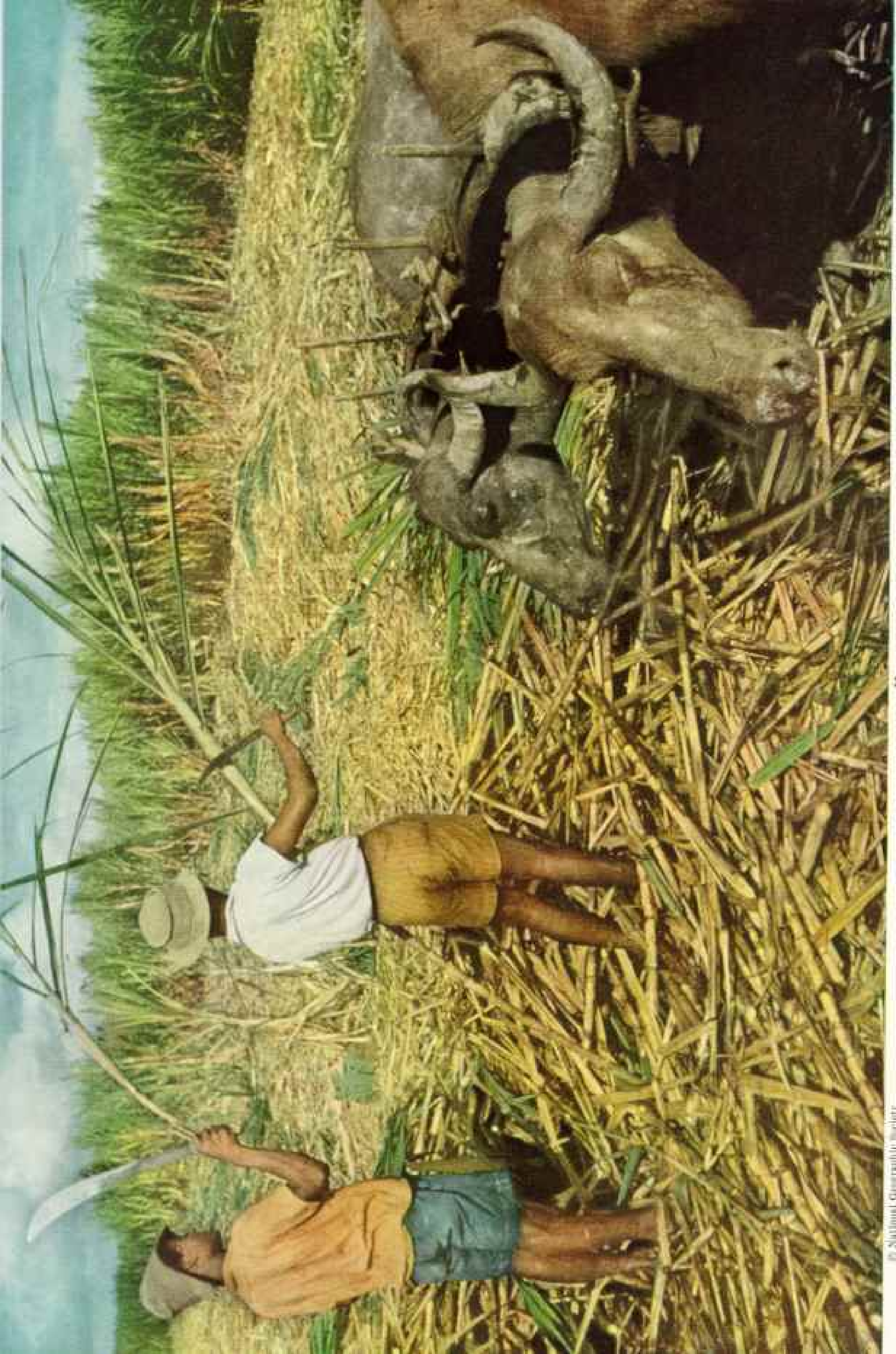


Bauxite Ore from Surinam Transfers at Point Tembladora. It Will Become Aluminum at Alcoa's United States Plants.

31

Photographs by Charles Allum







A Flashing Machetes Strip a Trinidad Cane Forest for Sugar, Molasses, and Rum

Capt. William Bligh, famous master in the mutiny on the *Boatwy*, was one of the first to introduce cane into the West Indies; he carried it in the *Providence* from Tahiti in 1793. Today sugar production is Trinidad's largest employer of labor. Many fields are burned off just before cutting to reduce trash and kill snakes and vermin. Large sugar estates are now highly mechanized, but water buffaloes often cut the stripped stalks to plants or rail sidings (page 69).

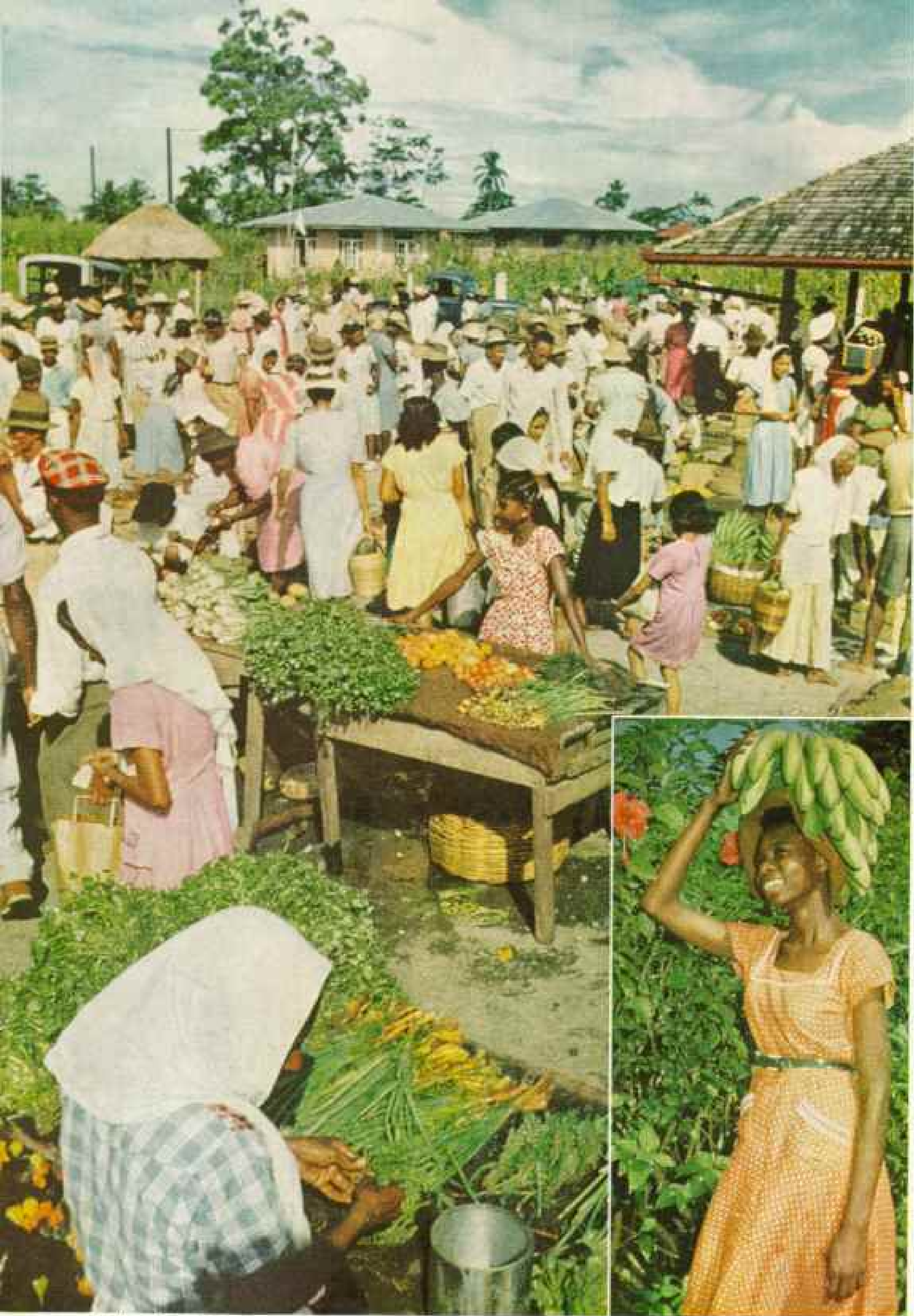
◀ A new plant may grow from each section of this stalk. In good soils, three to 10 crops may be harvested before replanting is necessary. This woman lays lengths of cane end to end; the man covers them several inches deep.

✓ Tobago fishermen launch a boat in Man of War Bay. Big enough to hold a fleet of whulammers, the bay was once a valuable harbor. Many sea dogs used to put in here to repair and refit, but commercial ships stop no longer. The bay takes its name from the man-of-war birds always hovering near. Charlotteville, some of whose houses rise on stilts, is Tobago's third town.

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Reproduction by Charles Altman



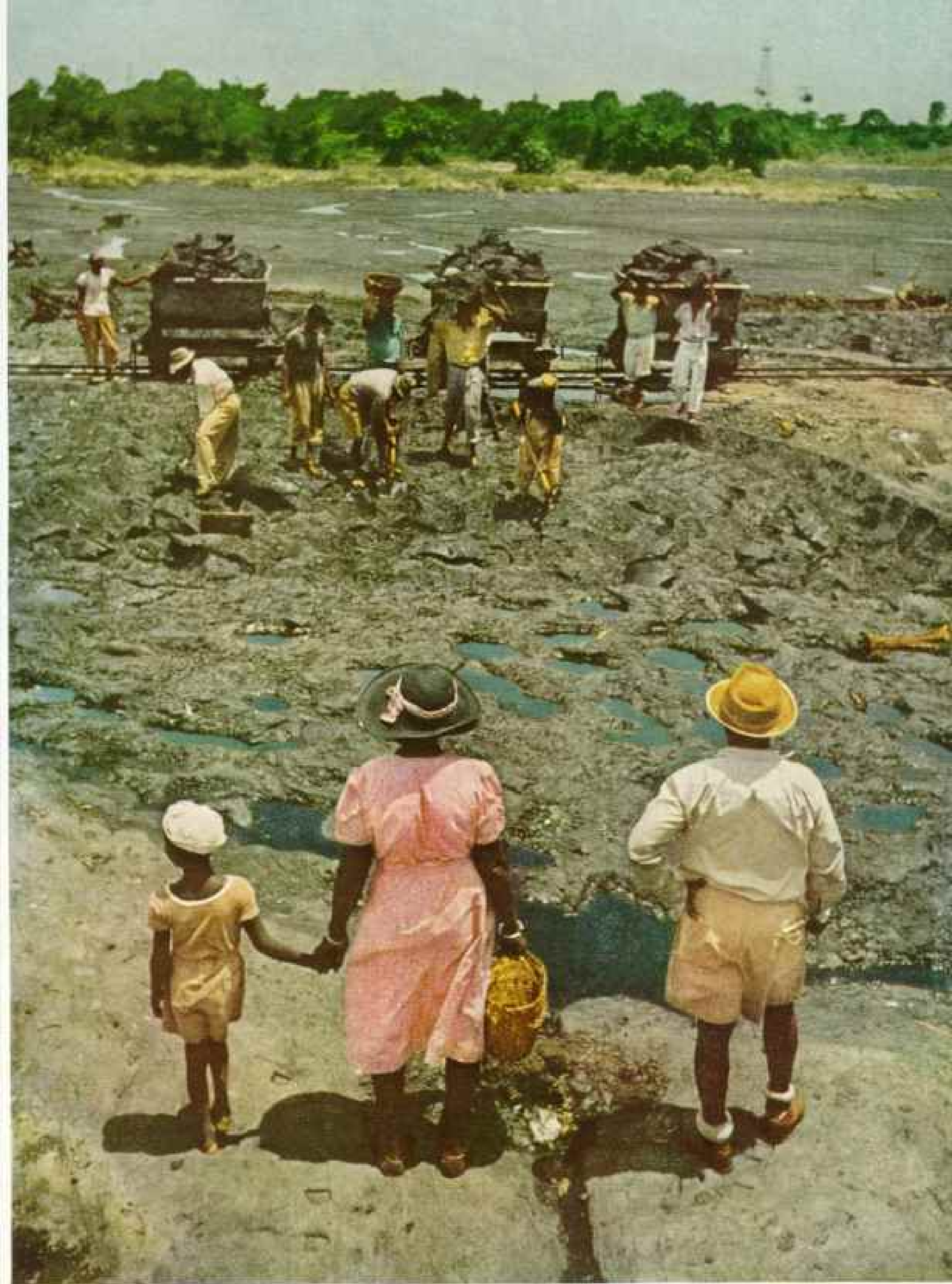


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Saturday's Market at Chaguanas Offers Groceries and Gossip for the Week

Chaguanas is predominantly East Indian, and Hindu women occupy most of these vending platforms. Inset: Back from market goes a Negro girl with bananas to ripen at home.



Heavy Picks Rob Pitch Lake of Asphalt for the World's Roofs and Roads

Rails must be moved frequently lest they vanish below the yielding surface. Even these watchers' heel prints fill up slowly. Occasionally the lake gives up bones from its 235-foot depths. Fish live in the rain pools.



▲ Gaudy Bird and Filmy Sari: Both Are Imported

Early inhabitants of Trinidad called the island *Iere*, "Land of the Humming-bird." Trinidad is still home to great numbers of birds, but this macaw is a visitor from South America.

The East Indian girl, whose head shawl came from her family's motherland, is a Trinidad native, the descendant of contract workers imported from Asia after the freeing of African slaves.

East Indians today make up about a third of Trinidad's population. They give parts of the island an *Arabian Nights* atmosphere complete with soft Hindustani accents, plaintive Oriental tunes, sloe-eyed beauties with bangles and nose ornaments, and snow-white mosques and temples (pages 66, 67).

Many of Trinidad's East Indians have become successful businessmen. This girl's father, a leading jewelry maker, fashioned her necklace before his death recently.

← Fruit and vegetable hucksters set up stalls by 5:30 a. m. at Saturday's market in Port of Spain.

This vendor offers pronged swizzle sticks for mixing drinks, and roots of cuscus grass, used for sachets and clothes-hanger covers because of its pleasant aroma. The bottle holds water for freshening vegetables.

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Illustrations by Charles Allison

The road skirted the eastern edge of the great Caroni Swamp, where thousands of scarlet ibises pass a tranquil existence, but where ducks are the prey of hunters during the shooting season.

The Colony's greatest agricultural wealth comes from the 83,500 acres of sugar fields, which produced a record yield of 159,135 long tons of sugar in 1949. The 1952 production was much less.

Although some 10,000 East Indian and Negro cane farmers supply about 35 percent of the canes ground by the factories, most of the cultivation is carried on by large companies. Many sugar workers tend their rice farms in the off season during the period of heavy rains.

I watched East Indian women place canes end to end in furrows in planting. Covered with several inches of excellent clay loam, a new cane will grow out of each section. As a rule, 18 months from planting to harvest is sufficient. The big estates seldom take more than three crops from a planting; the small farms take as many as 10 (pages 52, 53).

Fleets of tractors were being serviced in preparation for harvest work later, but they have not completely replaced East Indian water buffaloes, which are still used to haul cane from outlying areas of large estates to rail sidings (page 69).

Fiber from Cane's By-product

At the Caroni, Ltd., rail-sea terminal near Waterloo, I watched Negro stevedores loading lighters with bags of raw sugar. A ship lying a mile offshore was waiting to take the cargo to the United Kingdom.

I saw fiber from cane, a by-product called bagasse, being pressed into bales at a Caroni factory. Bagasse has found excellent use in the manufacture of fiberboard.

A total of 6,901,949 gallons of molasses was also produced by the industry in 1952. Some 4,000,000 gallons go to local rum manufacturers; a small amount is used in candy and in tobacco.

A few miles farther south I stopped to watch bulldozers bowling over coconut palms like so many duckpins. The new land was needed for cane, but, in addition, theft of coconuts had reduced the estate's output to the point where it was advisable to replant the land in sugar.

One of the tractor operators, a hefty, jovial Hindu, was fastidiously combing his long, glistening beard. I later learned he had once appeared in a short color film on the use of a particular make of tractor, and my camera apparently indicated he was once more to enjoy movie stardom.

In the town of San Fernando, tumble-down

corrugated iron buildings and modern stores stand shoulder to shoulder. Two Hindu women, huge gold nose rings thrust through the side of one nostril, fled when I attempted to photograph them. On another street I paused to snap Negro women with headloads of fruit and vegetables (page 42).

Of all the trumps in Trinidad's economic hand, oil is the most important. The island was the largest oil-producing country in the British Commonwealth at the outbreak of World War II, but Canada and Brunei, on the island of Borneo, have forged ahead.

Oil Shipped to Many Points

One afternoon I stood on a knoll near Pointe à Pierre, not far from San Fernando, with Dr. Arthur Down, refinery executive. We looked out upon the glistening tank farm and refinery of Trinidad Leaseholds, Ltd. (pages 49 and 50).

"There," Down indicated, "is one of the most important oil refineries in the British Commonwealth."

I looked down upon the loading jetty, reaching out to sea more than a mile. Tankers pick up cargoes here for transport to the United Kingdom and various parts of the world. Not far away several coasting schooners bobbed at anchor. Some markets, particularly the smaller West Indies islands, are supplied with oil products in drums carried on schooners or small powered vessels.

Not much attention was paid to Trinidad's oil until 1914-17, when the British Navy, which had recently changed from coal to oil firing at the order of Winston Churchill, turned the searchlight on the island.

The first refinery was built in 1917. Production from the Trinidad fields is supplemented by crude oil imported from Venezuela, Colombia, and even from the Near East, for refining in Trinidad.

The industry is highly progressive. More than \$33,000,000 was spent between 1945 and 1951 on exploration programs which are still active, and some \$24,000,000 has been spent by Trinidad Leaseholds for refinery modernization.

Industry in Heart of Jungle

South of San Fernando, some of the company-owned private roads replace Government thoroughfares. At one of the main gates a guard checked our identification before permitting us to pass. A few minutes later we sped along areas called forest reserves, Government-owned, but with mineral rights leased to private industry.

Dense jungle flanked us on either side. Arterial pipelines beside the asphalt road linked fields to refineries, delivering both indigenous



Bottlers Label Trinidad's Angostura Bitters for Bartenders and Chefs the World Over

The Siegert family guards the formula for the concoction, developed more than a century ago in the Venezuelan town of Angostura, now called Ciudad Bolívar. Originally a tonic, the bitters are used widely for cocktails and food seasoning. They are prepared nowhere outside of Trinidad (page 36).

crude oil and field gas for use as fuel in refinery heaters. Newly painted orange oil derricks loomed above the trees.

Our next destination was the United British Oilfields of Trinidad, Ltd., located in the southwest part of the island at Point Fortin, a completely self-contained oil community.

General manager at the time of my visit, William E. Madden, a life member of the National Geographic Society, told me how the oil industry is promoting Trinidad's welfare. Good relationships have existed between employers and employees for more than a decade.

Companies contribute generously toward housing, modern hospitals and dispensaries, sport grounds, clubs, schools, and churches. More than 350 apprentices are learning to be skilled artisans.

The Oilfields Workers' Trade Union negotiates for the employees and has steadily improved the laborers' standing. "Hard bargaining, but no hard feelings," Madden assured me.

The companies constantly explore for oil, but new fields are difficult to win. Of 158 oil companies that have been registered in Trinidad, only 11 remain active, and five pay dividends.

However, oilmen are confirmed optimists, a fact which became more evident as I moved into the south-central oil belt. Jungles were being cleared, roads constructed, and new wells drilled. Unusually large derricks, especially a 185-foot Parkersburg derrick soaring 212 feet overall, with equipment capable of boring some 15,000 feet into the earth, were employed at some places (page 48).

Nature's Asphalt Basin

Sometime later I saw Trinidad's peculiar mud volcanoes at a place called the Devil's Woodyard, east of Princes Town. These "volcanoes," bubbling caldrons in a flat, desert-like area, frequently cough up rock formations from deep below the baked mud-flat surface.

Pitch Lake, the one feature of Trinidad that



Ships Load Scrap Iron at Port of Spain, Transportation Hub of the Caribbean

Riches of the West Indies—sugar, copra, cacao, crude oil, and asphalt—pass through this fine sheltered harbor. Cargoes from distant seas are stored in warehouses (right) for reshipment to other West Indian islands, Venezuela, and the Guianas. *Mormacmar*, an American vessel, loads at left.



Costumed and Painted Trinidadians Celebrate Columbus's Discovery of Their Island

During the two days before Ash Wednesday, Trinidad goes wild with its Carnival. Steel bands bearing such names as Desperadoes and Fish Eyes compete for attention with parade floats (page 43). Costumes left over from Carnival find use again on Discovery Day, which celebrates Columbus's arrival in 1498.



Sir Walter Raleigh Calked His Ships with Asphalt Found on Trinidad's Shore

Despite intensive mining, Trinidad's Pitch Lake has dropped only 34 feet in 65 years, and seemingly inexhaustible supplies remain (pages 35, 58). The United States once paved city streets with the island's asphalt, but cheaper petroleum asphalt has largely replaced it. This barreled asphalt will surface streets elsewhere.

most people recall from school geography, is located in Trinidad's southwest arm (page 55). It is neither pitch nor a lake, but about 114 acres of natural asphalt. According to one view, earth fractures, indeterminate ages ago, caused masses of petroleum and gas to mix and ooze into the crater of a mud volcano, gradually filling up what has now become an asphalt basin.

There is a legend that Pitch Lake engulfed a tribe of Chayma Indians as punishment for their having killed and eaten hummingbirds, in which souls of their ancestors reposed. But whatever the lake may supposedly have swallowed, it has disgorged much—fossils of prehistoric animals, a "mystery tree" estimated to be several thousand years old, and upwards of 7,715,000 tons of asphalt since exploitation started in earnest in 1888. In that year Amzi Lorenzo Barber, an American, was granted a concession by the Government.

By the end of December, 1951, excavation had lowered the level of the lake by 34 feet, but internal forces continue to feed asphalt,

so that at the present rate of consumption of 150,000 tons per year, the supply should last for many generations.

Parking at the asphalt refinery at La Brea, I failed to heed the admonition of a passing factory worker.

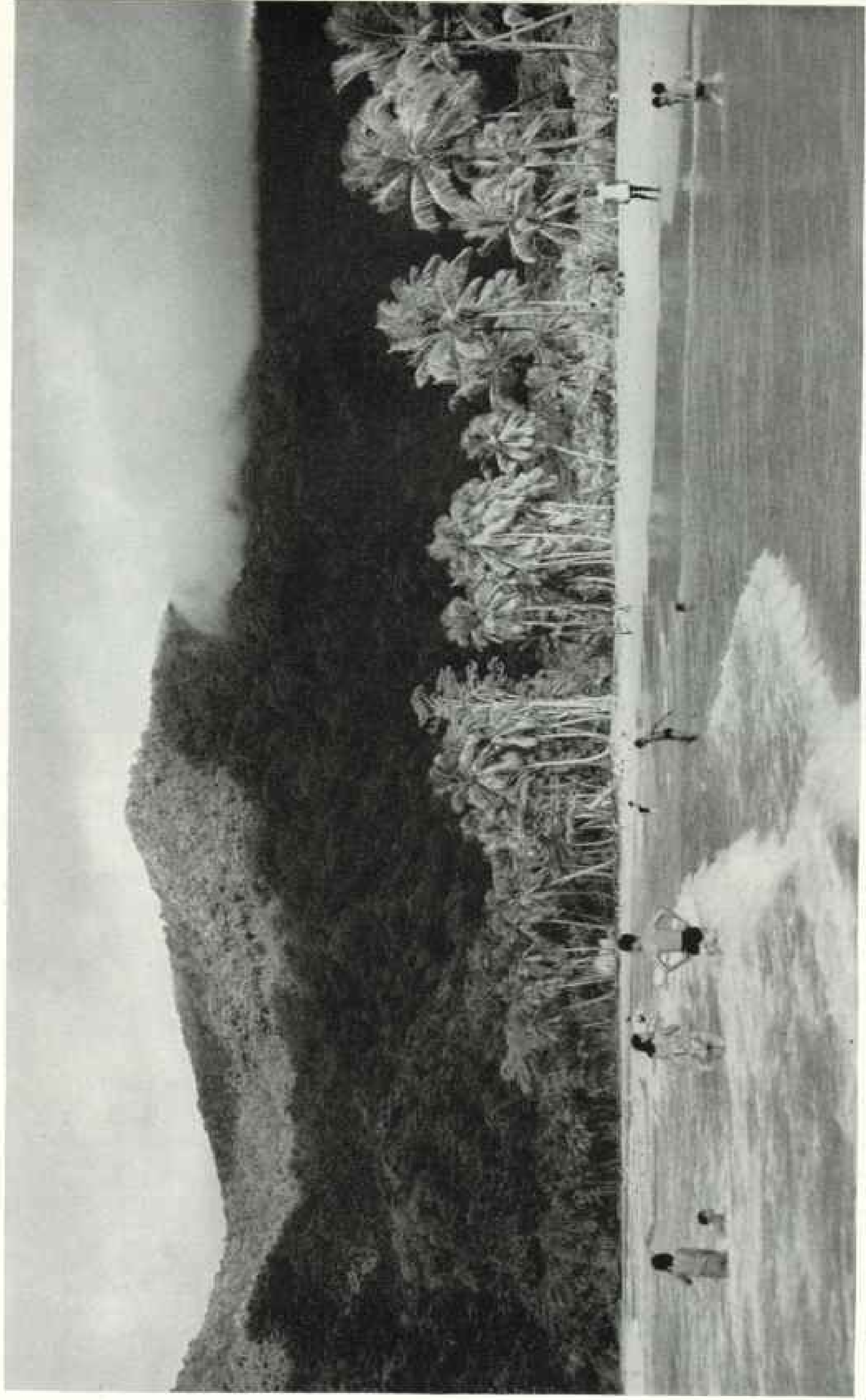
"Mahn," he warned, "you pa'k you' car inside, or when you come back you fin' she stick!"

Tracks Moved to Prevent Sinking

Walking out on the "lake," I found a gang of Negroes chipping out porous chunks of asphalt, which were dumped into waiting steel cars. After a while I noticed that my shoes sank a fraction of an inch into the asphalt, but it was possible to walk anywhere.

I learned that the narrow-gauge railroad tracks are moved every few days to prevent their disappearing. The lake is constantly shifting and finds its level in about four days, leaving no trace of digging operations.

Sir Frederick Treves in his *Cradle of the Deep* compared the surface of the lake to the



Mounted Police Enter Stables of Government House

For 300 years after Columbus claimed Trinidad for Spain, the island remained virtually uncolonized. In the 17th century, when Europe's maritime powers were at one another's throats, Trinidad suffered from raids by the French, Dutch, and English. In 1802 the island became a British colony; it has developed rapidly since.

Government House, home of the island's Governor, overlooks the Queen's Park, or Savannah, covering 199 acres. Most of Port of Spain's public life revolves around the park, with its race track, cricket pitches, rugby fields, and walks. Close by are the Royal Botanic Gardens, which Charles Kingsley described in *At Last: A Christmas in the West Indies*.

Except for a few British colonial career officers, Trinidad's police are recruited from creoles, Negroes, East Indians, and Chinese. Here Government House's white-coated guards enter the old stables with the colors of the Mounted Branch, Police Force. Stables are no longer in use, although the 132-year-old clock in the cupola still keeps good time.



skin of an elephant and the irregular creases to the folds in its hide.

A soft liquid asphalt patch, known as "mother of the lake," oozes to the surface near the lake's center. Rain water frequently fills crevices, forming small pools. At times small fish, locally known as "guahins," find a haven here, flopping with extraordinary power from puddle to puddle, dining on mosquito larvae and algae. How they get there is a mystery. One ichthyologist thinks it may be by flooding from other areas.

Following a string of loaded cars up the brief incline to the refinery, I watched as chunks of lake asphalt were reduced to liquid and poured into barrels for shipment. Pitch Lake asphalt products are shipped to some 35 countries. The asphalt has been used at some time on many famous streets of the world, including Pennsylvania Avenue, in Washington, D. C., Michigan Boulevard, Chicago, and the Victoria Embankment in London (page 61).

Amzi Lorenzo Barber, teacher, real estate developer, and capitalist, lived in Washington, D. C., for some years and became interested in Trinidad asphalt as paving material. Partly through his efforts, the National Capital became the first city in the United States to make large-scale use of asphalt for paving.

Car Sinks into Asphalt

Four hours later I strode back to my car. Several workmen stood by to witness my "departure."

The usual asphalt pavement calls for the incorporation of sand or some other aggregate to form a hard surface, but here in Trinidad only crude asphalt was used. Now I learned that autos must be parked beneath a shelter away from the hot sun, which softens the crude asphalt.

The wheels of my car had sunk five inches; I could not have been more neatly stymied if chock blocks for an airplane had been placed both front and rear.

Several factory workers "lifted" me out, but not before my earlier acquaintance came along to add, "Mahn, I tell you so!"

Pitch Lake, Angostura Bitters, and Maracas Bay do not comprise the total of Trinidad's attractions. One of a different kind is the calypso, that folk lampoonery full of local and topical allusions and composed more or less spontaneously by the singer.

The calypso's inspiration dates back to the days of French settlers in Trinidad, according to one school of thought. Their influence soon became dominant among the slave population. The French patois became the "lingua franca" of the island, and the Negroes listened to songs betraying the Gallic touch in satire.

The plantation aristocracy did not discourage ballads and extemporaneous music made by slaves for their own entertainment at inter-estate games. Into their own ballads the Negroes brought their love of color and make-believe; they also began to ridicule their "small island" friends and to deride the overseer right under his nose. After 1890, English words fast superseded the French patois.

Thus calypsoes grew, drawing elements from native religious songs of the Negroes.

Spanish Influence Detected

The characteristic rhythm is primitive; sometimes the hearer detects a touch of Spanish influence akin to the *samba* of Brazil. But in Trinidad it is less sophisticated, better attuned to bottle-and-spoon orchestras, guitars, and steel bands.

The calypso gradually became commercial entertainment, especially with the advent of the American tourist. It has now spread to other islands in the West Indies.

Calypsonians today are known by the glittering titles they bestow upon themselves. The best known is probably Lord Invader, who soared to international fame with his popular "Rum and Coca-Cola." Locally famous are King Radio, Small Island Pride, Atilla the Hun, the Mighty Killer, Lord Beginner, Lion, Lord, and Lady Iere (opposite and page 34).

Among calypsoes popular at the moment are "Norah," "Ramadhin on the Ball" (inspired by Trinidad's cricket star, Sonny Ramadhin), and "Tobago Love." A perennial favorite is "It's Love and Love Alone That Made King Edward Leave the Throne." I heard others such as "In a Calabash," "I Wouldn't Work if They Killed Me Dead," and "Always Marry a Woman Uglier 'n You."

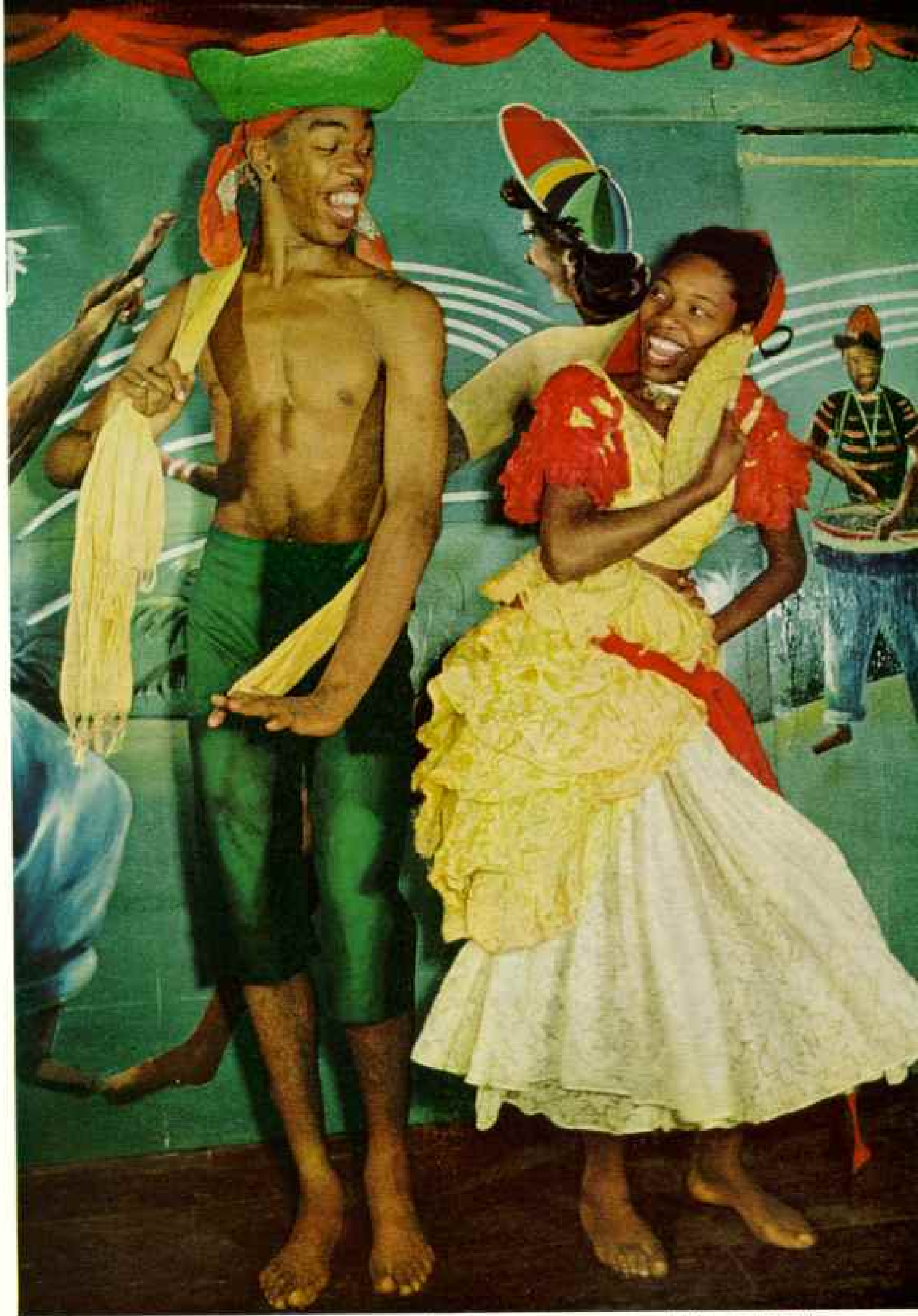
The Colony's pre-Lenten Carnival lasts only two days, but preparations go on for weeks beforehand. A Carnival queen is selected. Noise and festivities gather momentum as the fete nears (page 60).

In recent years, as Carnival time approached, boys began stealing garbage containers from back yards. These steel drums at first provided only clumsy noisemakers, but from them grew the now famous Trinidad steel bands (page 43).

Bands March on Special Days

Ingenious alterations to a steel gasoline container can transform it into a musical instrument producing as many as 23 different notes. The music resembles somewhat that of the marimba, but the tones are not as soft. Fifteen or 20 or more musicians play in perfect harmony, although chances are that not one can read music.

At Carnival time, Columbus Day, and other



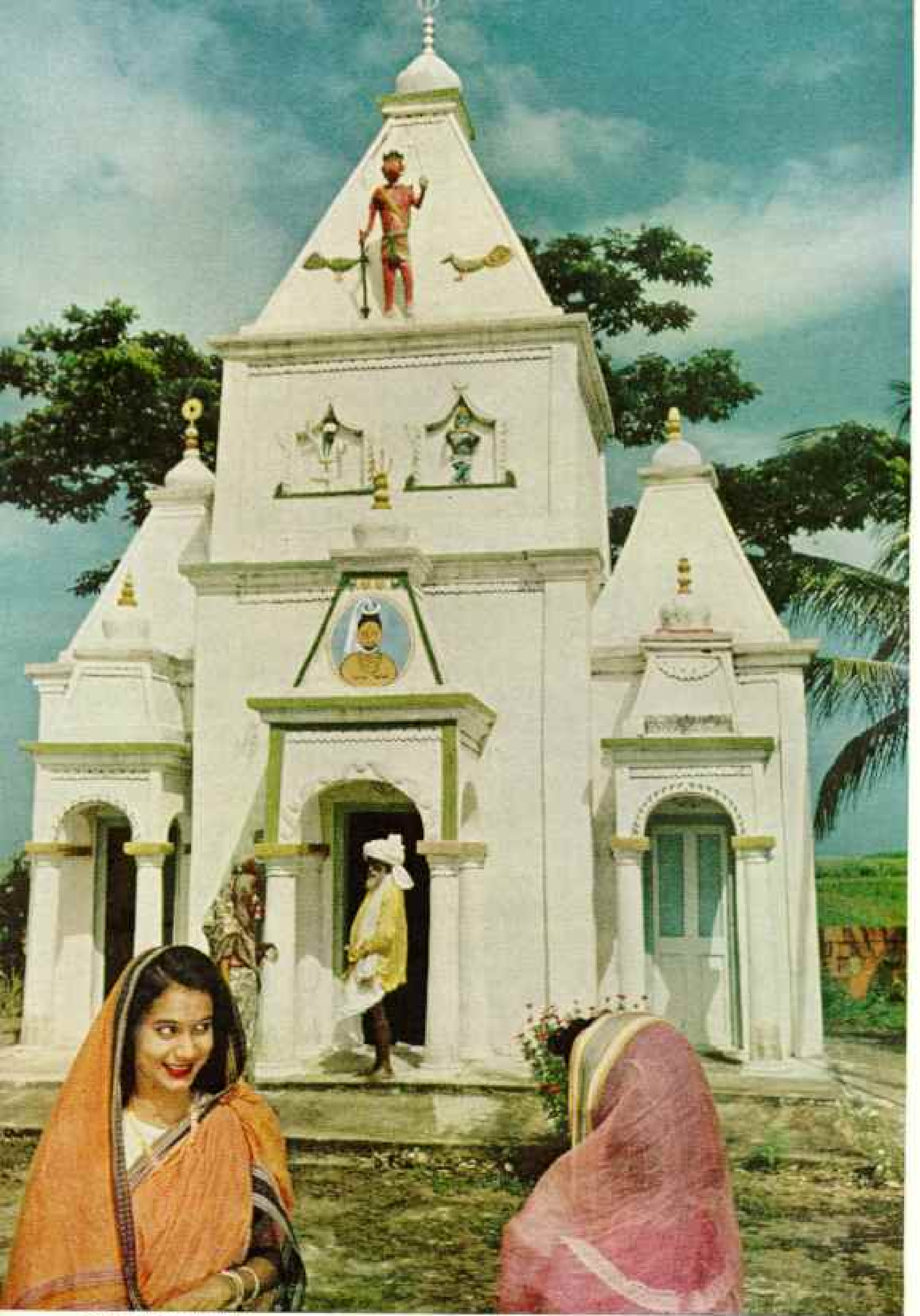
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Kodachrome by Charles Allmon

Calypso Melodies and Native Dances Entertain at a Port of Spain Night Club

Geoffrey Holder, 22-year-old dancer (left), creates costumes for his troupe and presents his own adaptations of West Indian folk dances, such as the *shango*, *bongo*, and *limbo*.



West Becomes East: Saris, Turban, and Hindu Temple Suggest a West Bengal Scene
 Many Moslem and Hindu women in Trinidad cling to the Indian sari. Here a priest watches from the doorway of his temple near San Fernando. Hindu deities stand guard above.



Blowing of a Conch Shell and Ringing of a Brass Bell Accompany Hindu Prayers

Images of deities look down on an altar near Las Lomas decorated with hibiscus flowers, prayer beads, and lamps. Doon Pundit, the priest, wears a British decoration honoring his service to Trinidad's Hindus.

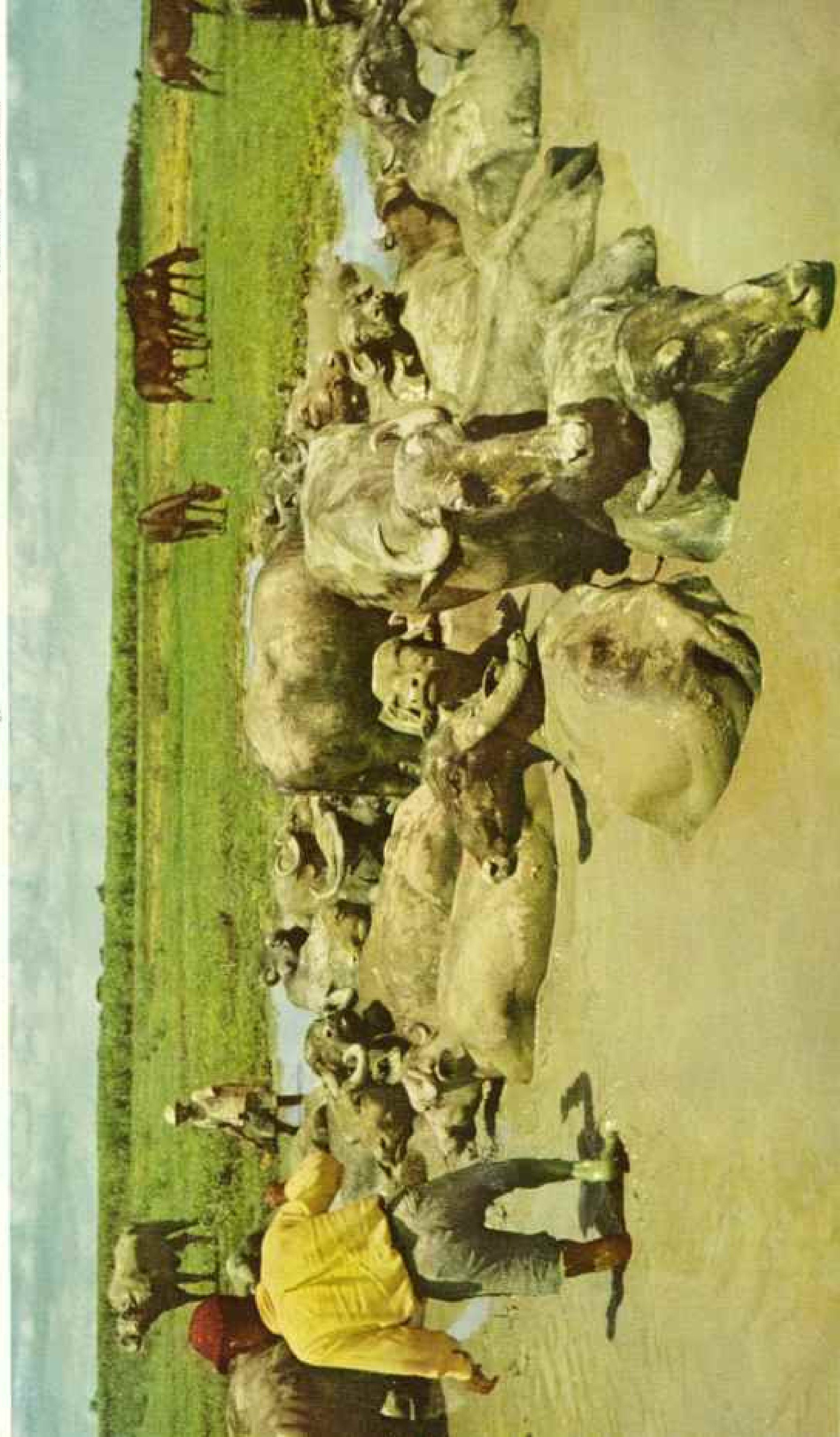


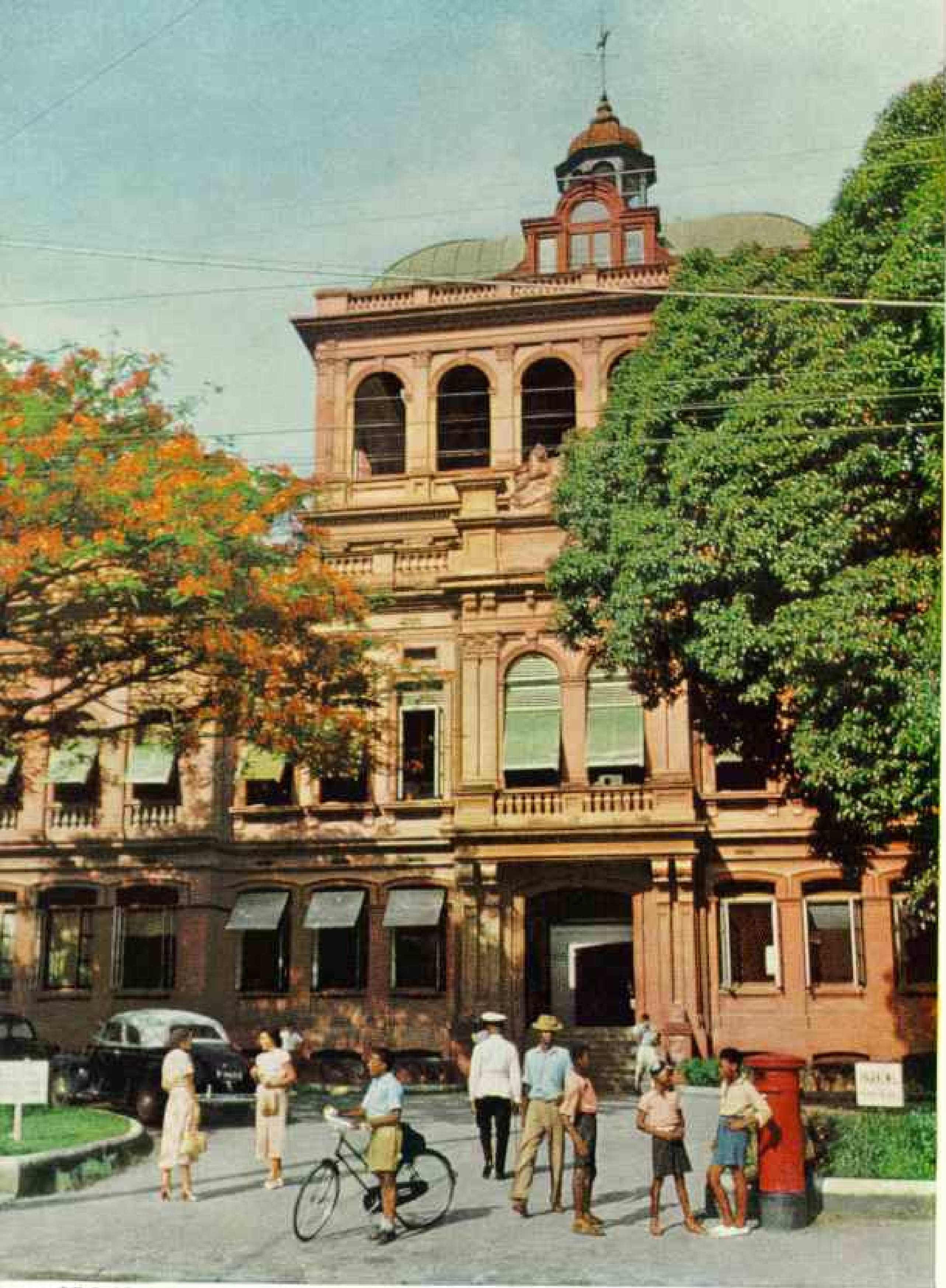
Water Buffaloes, Escaping Summer's Heat in a Comfortable Sen of Mud, Resist Efforts to Drive Them Back to Work

Buffaloes, imported from India, do heavy hauling to rail sidings on sugar estates. These docile beasts contrast strikingly with their fierce African cousins. They share work with mules on the Caram estate.

69

Reproduction by Charles Allison





Affairs of State Are Decided in Port of Spain's Red House on St. Vincent Street

Renaissance-style Red House was built in 1906 to hold executive offices and the Legislative Council Chamber. Brilliant flamboyant blossoms and circular red mailbox add color to the scene.



Cacao Pods, So Heavy They Grow on Stout Branches, Hang Like Japanese Lanterns

Each pod holds 40 to 60 oval seeds. Roasted and ground, they flavor many a chocolate bar. Cacao trees need shade; this one grows in the shelter of an immortal, whose trunk appears at left.



Man Friday's Footprint Startled Robinson Crusoe on a Beach Like Tobago's Pigeon Point
 Tobago calls itself "Robinson Crusoe's Island," for Daniel Defoe described a place resembling it. Alexander Selkirk, who inspired the story, was marooned on one of the Juan Fernandez Islands off Chile.

special holidays, the Port of Spain police authorize a limited number of bands to march in the streets. Rivalry is keen, and sometimes brawls break out among competing bands from different neighborhoods. I happened to be in Port of Spain for the Columbus Day celebration, when 40 steel bands were authorized to march. Incidentally, Columbus Day here is July 31, but it is always celebrated on the first Monday in August.

How I ever managed to overhear a conversation in the din, I cannot imagine now. Near by a Negro stevedore was discussing the lady of his affection. "I love she, I love she eyes, mahn," he murmured rapturously.

The inhabitants of Tobago, Trinidad's "little brother," feel a similar affection for their tiny island. My anticipation was high as I boarded a British West Indian Airways Vickers Viking for the short flight to Crown Point. My car had been shipped by coastal steamer the day before.

Just twenty miles from Trinidad's northeast coast, Tobago was early destined to be thrown into the maelstrom of international conflict. Columbus discovered it in 1498. From 1666 to 1684 the island was tossed six times between the English, French, and Dutch. Since 1814 it has been under British rule and in 1889 it was joined to Trinidad administratively.

Setting for Crusoe Story

From the air I observed commodious harbors. Our plane afforded a view of the entire island, 26 miles long and $7\frac{1}{2}$ miles at its widest point. Ridges of green hills rise gradually from the flat southwest tip and extend to the extreme northeast. The highest point is 1,890 feet above the sea.

Tobago claims to be the setting for Daniel Defoe's famous story, *Robinson Crusoe*. The author was inspired by the true adventures of Alexander Selkirk, a sailor marooned for more than four years in the Juan Fernandez group off Chile,* but with writer's license Defoe may have turned to a published account of Tobago for his local color (opposite page).

I took a room at the Robinson Crusoe Hotel, about a mile from Scarborough, the capital.

"Look me here," the bellboy announced in answer to my summons. "Can I make a message for you?" This I translated mentally, "Here I am. Do you wish to send a message to someone?"

I merely wanted to learn whether my car had been safely delivered to the harbor master's office at the Scarborough dock. It had; so I set out to explore the island.

Scarborough village is situated partly on a hillside. Its substantial buildings do not look their 150 years. The ruins of ancient

Fort George dominate a near-by knoll (page 75). In the crowded square, bustling with activity on Saturday, a babble of voices rose to an over-all roar.

Some of Tobago's roads are paved with Pitch Lake asphalt. I saw windbreaks of mahogany trees surrounding some of the finest coconut estates in the West Indies.

At Frank Latour's Golden Grove Estate workmen deftly split coconuts into thirds with cutlasses. Women gouged out the meat with special knives; the husks served as fuel in the kilns which dried the copra. The husks are also shredded by machine into fiber for the furniture trade. One workman engaged in this operation almost collapsed of fright when I shot off a flash bulb in my camera.

DDT Routs Mosquitoes

The cooperative Coconut Growers' Association, Ltd., has improved marketing conditions for the industry, which is enjoying greater prosperity than ever before.

A fine mosquito-control program has made malaria almost unknown in Tobago. I frequently passed groups of men squirting DDT into every possible breeding place of the *Anopheles* mosquito.

On Sunday I joined the Tobagonians for swimming, fishing, and picnicking at Pigeon Point. The European colony numbers about 100; most of the rest of the 30,000 inhabitants of Tobago are of Negro origin, although there are some East Indians.

As I sat on the beach peering through a pair of binoculars, great brown pelicans plunged into the water for fish. It seemed to me that they would knock themselves out, but they always managed to go winging off over the green-blue lagoon with their prey in their beaks. Pelicans by the hundreds congregate at Buccoo Reef, less than two miles offshore.

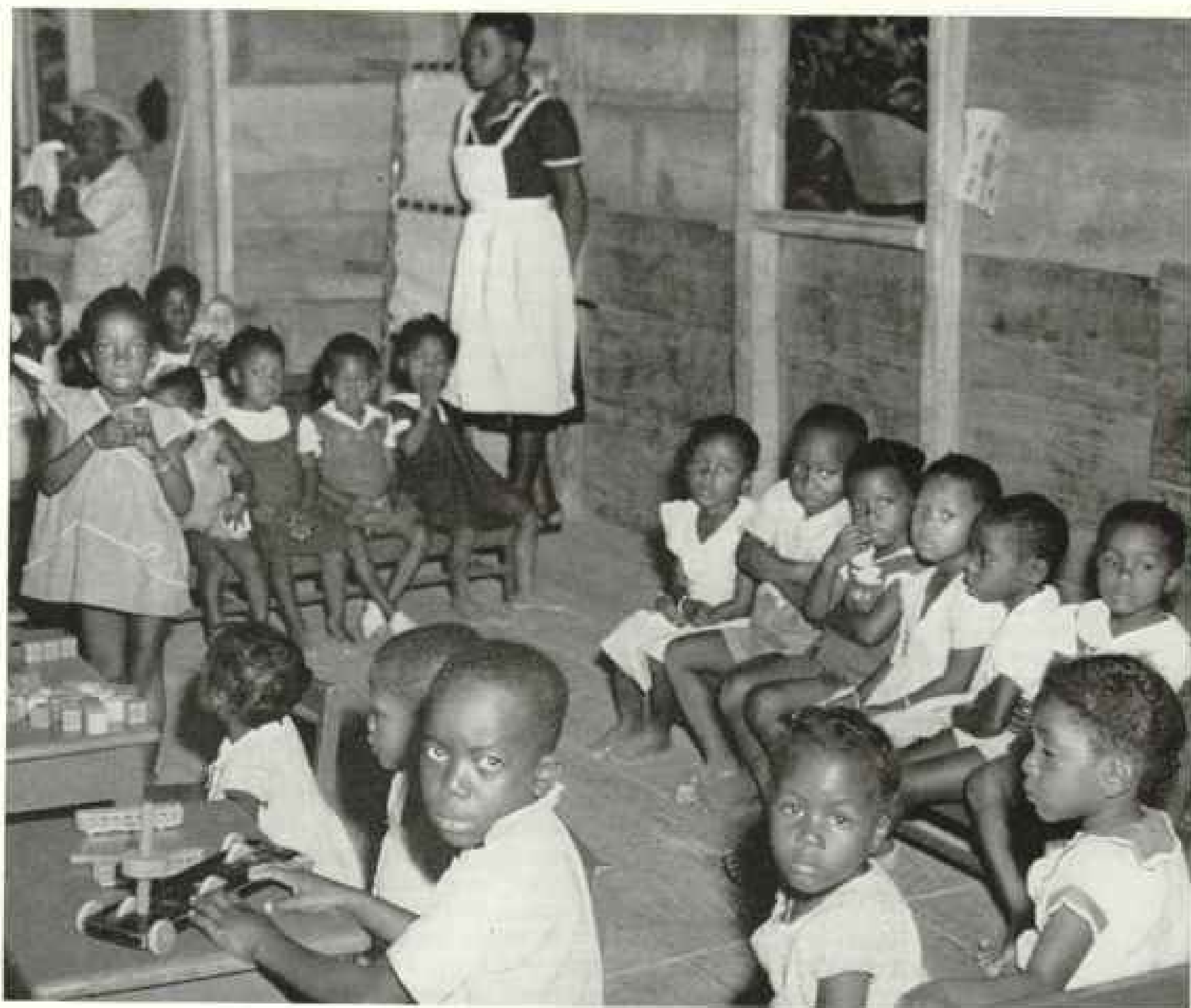
Here British Fought French

I took a boat to the reef. On the lagoon floor sponges grow in about six feet of water. I put on diving goggles and explored a fascinating underwater fairyland inhabited by multitudes of magnificently colored small fish.

Near Plymouth I found an entire community helping to haul in huge nets. Hard by Plymouth is Black Rock, where, in 1781, a Major Hamilton with a few British soldiers futilely attempted to fight off a French invasion force of nine ships and 3,000 men.

Among the strange relics in the village is a tombstone marking the resting place of a woman and child buried in 1783. Its curious

* See "Voyage to the Island Home of Robinson Crusoe," by Waldo L. Schmitt, NATIONAL GEOGRAPHIC MAGAZINE, September, 1928.



Golden Lane Nursery School Gives Tobago Mothers Time to Work in the Fields

Education is free and compulsory for children aged 6 to 12 who live within two miles of a school. This private kindergarten near Moriah was organized by Mrs. R. H. Harrower.

epitaph invites conjecture. "She was a mother without knowing, and a wife without letting her husband know it except by her kind indulgences to him."

Stone towers are all that remain of old windmills which once furnished the power for grinding sugar cane. It is hard to remember that much of Tobago was once planted in sugar, for now an occasional patch is all that may be seen. Copra and cacao make up the main products.

Nursery Aids Working Parents

With Capt. R. H. Harrower (page 68) and another retired Army officer I drove to Castara, end of the road on Tobago's north-central coast. The valleys and ridges of this hilly section were dotted with modest wooden and corrugated-iron homes.

At Golden Lane we stopped to see a nursery school near Moriah. Mrs. Harrower had taken

the initiative here in organizing a nursery where working parents might leave their children during the day. Curious smiles and wide-eyed stares came from the black faces of these youngsters while I took their pictures.

A few days later I set out for Speyside on the eastern part of the island. Rolling along the curving thoroughfare on the south coast, I stopped many times to admire the scenery. At almost every bridge I could look down upon a Negro washday in the fresh-water stream. Quite often a naked youngster got into the act, receiving a good scrubbing along with the soiled clothes.

From my room at Speyside's Bird of Paradise Inn I looked across to Little Tobago, or Bird of Paradise Island, which lies two miles off Tobago's southeast coast. This mile-long sanctuary is one of two localities in the world where wild birds of paradise can be seen. The other is the region centering in New Guinea



A Ship's Cannon at Fort George Calls to Mind Tobago's Stormy Past

Deep indentations in the Tobago coast once sheltered warships. Fort George, built by the English, stands in ruins. This antique gun defended the entrance to Rockly Bay and the town of Scarborough (not shown).

to which they are indigenous (pages 44-45).

In 1909 Sir William Ingram, who owned Little Tobago, brought about 50 immature specimens of the greater birds of paradise from the Aru Islands, Indonesia, southwest of Netherlands New Guinea, and set 44 free on the island. After Sir William's death in 1929, his sons presented the island to the Government of Trinidad and Tobago, on condition that it be kept as a sanctuary for the birds.*

Fruit trees have been planted especially for the birds, and once each week water is taken to the island for them. The shy creatures are occasionally seen by fortunate visitors.

Spacious Man of War Bay

Along the northeast coast is Man of War Bay, one of the finest of Tobago's harbors (page 53). Windjammers, requiring plenty of

sea room, could maneuver within its perimeter. The fishing village of Charlotteville sprawls down a hillside to the bay's edge.

From the top of a hill near by, the view was breathtaking. Steep ridges ran down to the sea. Magnificent Man of War Bay spread out below me, and Pirates Bay lay down to my right.

These picturesque names conjured up visions of a colorful past. Adventurers and explorers, masters and slaves, wrote the early history of Trinidad and Tobago.

Does a quieter future belong to oilmen and airmen, to sugar growers and gregarious stevedores, to acid-tongued calypsonians and their tourist admirers?

* See, in the NATIONAL GEOGRAPHIC MAGAZINE: "New Guinea's Paradise of Birds," by E. Thomas Gilliard, November, 1951; and "Strange Courtship of Birds of Paradise," by S. Dillon Ripley, February, 1950.



Rare Specimens from Remote Places, Destined for Zoos and Aviaries,
Flash Their Colors in a New York Distribution Center

BY PAUL A. ZAHL

With Illustrations from Photographs by the Author

DEEP in the Guiana jungles of northern South America a loincloth-clad Arawak Indian makes his way up a rocky gorge toward a misting, roaring waterfall. Holding a bow and a curiously blunted arrow, he bends intent upon something hidden in the shadows of an overhanging crag.

Suddenly his body freezes. With slothlike deliberation and singleness of purpose, he draws a bead. The arrow leaps forward.

An instant later the huntsman is clambering up the rocky incline. Soon he descends with a flame-crested bird about the size of a small pigeon, stunned but unhurt.

By nightfall the fabulous cock-of-the-rock, in a crude raffia cage, sits secure in the bird-catcher's dwelling, awaiting the monthly launch from far downriver. On its arrival a few yards of calico change hands, and the gorgeous bird joins bizarre species already collected from other Indian settlements.

Then follows a long journey to coastal Georgetown, British Guiana, where the rare shipment is placed aboard a Pan American plane. Within 18 hours the cock-of-the-rock is a resident of Manhattan, a pampered guest in a hostelry for exotic birds. Fellow guests include others of his kind, captured in baited nets in Colombia (pages 79, 81, 83, 97).

Appetite Betrays Java "Ricebirds"

In another corner of the world, near the edge of a ripening rice field in Java, a honey-skinned native sprinkles seeds before the crudely camouflaged opening of a twig-woven trap. A moment later he unrolls a ball of twine, fastens one end to a trapdoor arrangement, leads the other to a thicket perhaps 50 feet away, and there stealthily crouches.

Presently a few of the red-beaked, sparrow-sized birds flickering about the rice field

discover the seed. Excitedly, others join them. A hundred or so are now pecking away at the bait, and soon, following a trail of seeds, some enter the trap's opening.

Suddenly the twine leaps taut, the pin is jerked away, the trapdoor drops. Within, those betrayed flutter uneasily, though oblivious of the sharp turn their destinies have taken.

By nightfall the native has reached his village hut, where he transfers the booty to a large cage containing the catches of previous days. Two weeks later the collection of handsome Java sparrows, or ricebirds, is in the hands of a dealer in Djakarta (Batavia), then aboard an Amsterdam-bound plane, to be transhipped across the Atlantic to a New York distributor of exotic birds (page 95).

Hotel for Fantastic Foreigners

Captured in a hundred different ways, rare and fantastic species from remote parts of the world thus find their way to the little 5-story building of Louis Ruhe, Inc., hidden in the gloom of the Third Avenue elevated, deep in the wilds of Manhattan's Bowery.

The street floor of this establishment hardly distinguishes it from the conventional pet store. There are the usual canaries singing joyfully and flitting about their cages, the clerk behind the counter, the brown sacks of bird seed, the empty cages for sale.

To see how unusual the place is, one must ascend to the floor above. There Howard La Vine, Ruhe's bird and animal man extraordinary, may be uncrating a new shipment of barbets from Colombia or a consignment of finches from Australia. Under his supervision, the birds are nurtured and carefully readied for transshipment throughout the Nation.

In the cages lining the softly lit room the visitor sees flicks of green, red, orange, yellow, and blue. A myna bird from India screeches out partly recognizable words; a bellbird from the mountains of Venezuela sounds its chime; small South American toucans cock their huge-beaked heads in curiosity at the visitor.

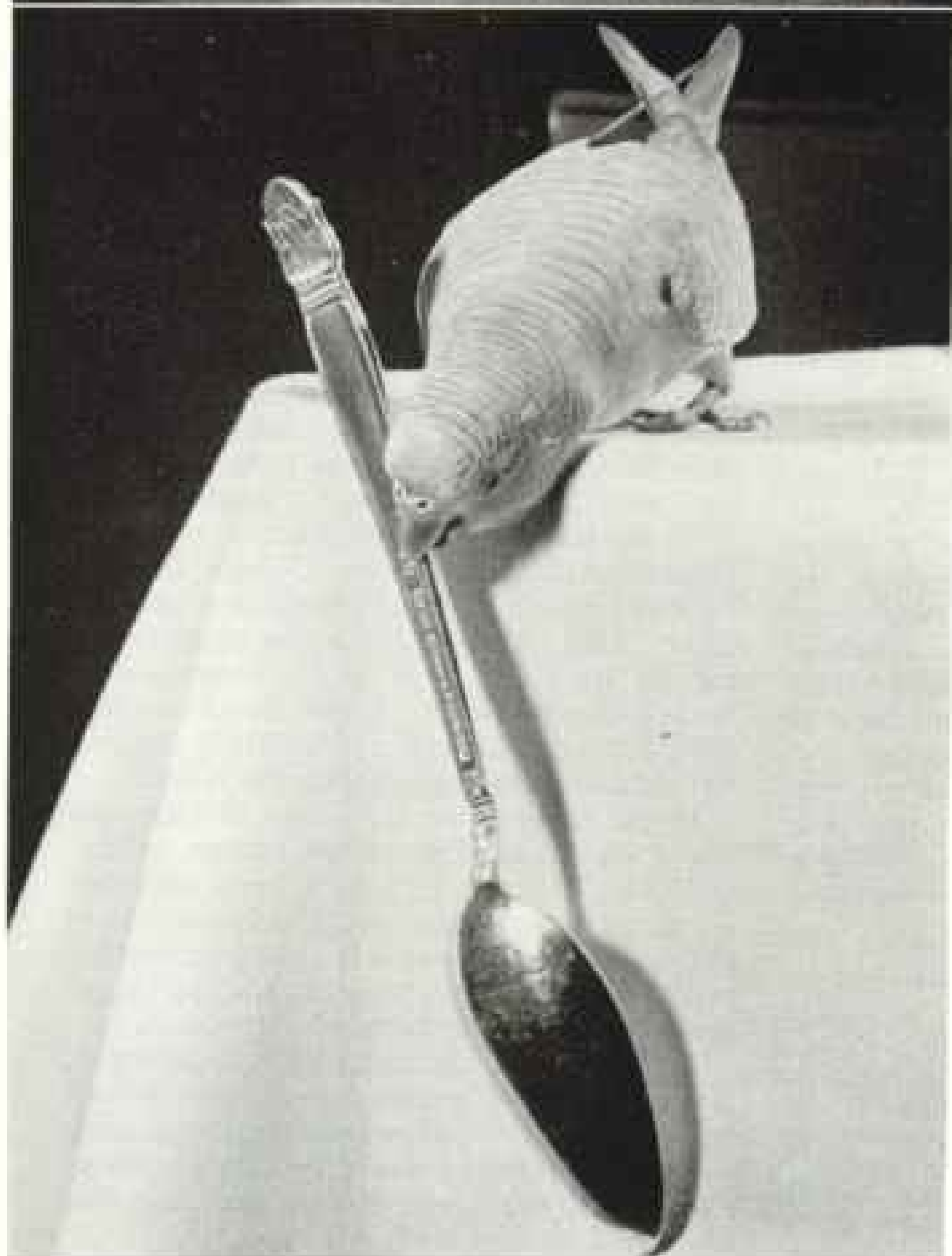
Attendants are cleaning cages, preparing an enormous pile of peeled banana and halved apple fodder, or refilling feed trays with seed.

Amid the chirping and screeching of a thousand birds, one hears, smells, and feels the essence of strange lands.

National Geographic Photographers Robert F. Brown and Donald Moffatt

Paradise Whydah from Africa Dons Elegant Mating Garb

Broad black tail plumes up to a foot long adorn the male in the breeding season, turning him into a show-off for several weeks. Head, throat, back, and wings are black, collar is chestnut, under parts buff. Molting, sobering his behavior, returns him to prosy dress resembling that of his sparrowlike female. A species of weaver finch, the canary-size paradise whydah adjusts well to aviary life. This one thrives at the National Zoological Park, Washington, D. C.



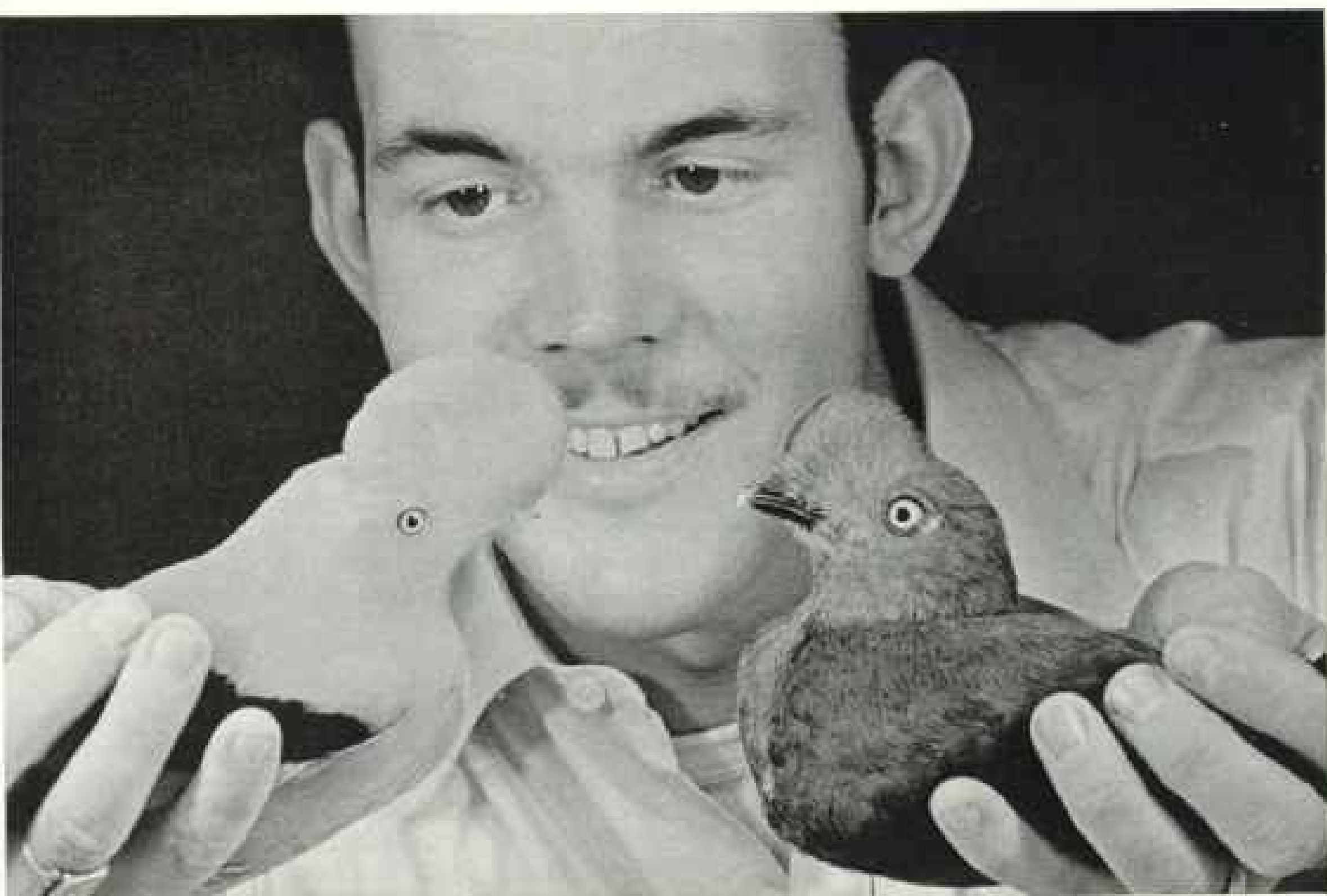
These Pet Parakeets Enjoy Unsetting the Table

Two blue parakeets, six months old when photographed, spice home life for the R. L. Cardons of Alexandria, Virginia. Dumping table silver on the floor is to them a duty as well as a pleasure.

Bird generations ago, the parakeets' ancestors roughed it in the Australian bush. Known there as budgerigars (page 86), they were predominantly green. European breeders, importing them, led in developing new color varieties, chiefly yellows and blues. Now Australians, Europeans, and Americans vie in improving parakeets and in extending their popularity as cage birds. Easily kept, such pets live long and show the "intelligence" of their larger parrot cousins.

Sally (top) has cobalt-blue breast, white cap, zebra stripes of brownish black and gray on back and wings, and navy-blue tail. Mischievous Albert (or perhaps Alberts) has sky-blue breast, gray and white zebra stripes.

National Geographic Photographers
Robert F. Brown and Donald McEwen



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A Second Later the Male Cock-of-the-Rock (Left) Tried to Kill the Female

A Manhattan firm dealing in exotic birds almost had a tragedy on its hands when these South American guests were uncrated and posed. As quick as a cobra, the resplendent male fastened his beak in the female's head, narrowly missing an eye. Howard La Vine (shown) separated the two (page 97).

Sometimes a chauffeured limousine drives up to the shop, its wealthy occupant having come to select newly arrived specimens for the embellishment of a private aviary.

By far most of the bird importations are shipped off to adorn the great zoos of the land. There the public will view these creatures from far-off places, quite unaware of the variegated history of capture, barter, travel, and nurture that lies behind each handsome specimen.

"Bowery Safari" Has Its Hazards

It was here in the Bowery that I recently assigned myself the task of obtaining portrait and flight color shots of foreign birds. Approaching this task, I recalled the inclemencies of many a tropical jaunt in pursuit of birds in the natural state.* This urban project held promise of a change to relative ease and convenience. The mountain had come to Mahomet. This would be like shooting fish in a barrel, friends suggested.

As it turned out, the job of "shooting" untamed, albeit caged, birds was as arduous and patience-taxing as any binocular-and-blind safari and posed a basketful of problems never encountered in the field.

Take the toco toucan of South American jungles, a nervous bird whose yellow and red beak is nearly as long and massive as its body,

with edges sharp and raspy enough to inflict a serious wound on any human finger it might engage (page 85). Clearly, in working with this species, special techniques are necessary to prevent injury to bird or handler.

Fortunately, such techniques were well understood by Howard La Vine. When we needed a toco he would enter the room-size cage where such birds were allowed to fly free. Rejecting a net as possibly injurious to so jittery a creature, he watched as the dozen or so excited toucans flew overhead. Then suddenly he made a perfectly timed leap, catching the desired bird from the rear with one hand and with the other quickly restraining its threatening beak—and all this without the bird's losing a feather.

For a few minutes Howard made cooing bird-language noises close to the captive's head. The uneasy creature slowly quieted down and thereafter, if handled gently, was amenable to the flashes and other vicissitudes of being photographed.

For smaller birds my friend used an ordinary butterfly net. Tiny finches, for example,

* See, in the NATIONAL GEOGRAPHIC MAGAZINE: "Flamingos' Last Stand on Andros Island," May, 1951; "Search for the Scarlet Ibis in Venezuela," May, 1950; and "The Pink Birds of Texas," November, 1949, all by Paul A. Zehl.

on arrival from abroad, were often released to join hundreds of others in a large wire enclosure, the small-bird room. As I pointed, say, to a certain Gouldian finch sitting on a set of branches in company with several hundred cordon bleus and zebra, fire, and strawberry finches, he waved the whole group into flight with one arc of the net wand. On the return sweep he almost invariably captured from out of the swarm the single specimen designated—and only that one!

Some Demure, Others Excitable

For close-up action pictures, small birds were allowed to fly free in variously sized chambers equipped with a system for flash illumination. They were photographed through a panel of glass fitted on the inside with a sheet of cellophane, loosely adjusted to act as a protective buffer for any birds attracted to the window.

Each species had its own distinct personality. Chesty little Java ricebirds hopped up onto the twigs provided, primping and behaving adorably for the camera (page 95). Troupials leaped incessantly from floor to branch, from branch to floor (page 93). Cut-throat finches stormed the branches, sometimes piling up two or three deep. Myna birds looked talkative but remained apprehensively silent (page 90).

Toucan-barbets turned glum and angry and appeared eager to take a piece out of someone's skin, a feat of which their groove-point beaks make them fully capable (page 93).

So seemingly demure a creature as the violet-eared waxbill from South Africa often sat motionless on the bottom of the chamber, uninspired and unattracted by twigs, seeds, or fruit dishes rigged up near the window (page 94).

In contrast, yellow-winged sugarbirds, when loosed into the chamber, would create a bedlam, beating against the window and soiling it so quickly as to make photography a problem. The only way to work with so skittish a subject was quickly to drape a quieting curtain over the front of the box, remove the birds, wash the window, and try it again (page 87).

The male pin-tailed whydah, a bird with long tail feathers that shimmy quaintly in flight, also proved to be a tough customer when it came to posing. Like the violet-eared waxbill, it pouted on the bottom of the chamber and refused to perch on any of the props provided.

Finally we decided to try decoys. We introduced a few cordon bleus and some golden-breasted waxbills, which immediately obliged by flying about and landing on the appropriate perch. Soon, not to be outdone, the whydahs

followed suit and so came into camera range (page 82).

During such confinement care was taken to prevent any movement whatever by observers outside the glass window. The slightest disturbance could throw otherwise gentle birds into a fury of fluttery excitement. Luckily, during more than 3,000 exposures involving hundreds of birds, not one was hurt.

For action shots we wanted the birds to fly naturally. Fortunately, the pictures were being taken at a flash speed approximately 1/15,000 of a second, too fast to be annoying to the birds but sufficient to freeze all motion.*

Some of the pictures taken thus lent themselves to interesting aeronautical comparisons. This applied particularly to the small birds, for they and their aerial analogues, the insects, accelerate and decelerate with a suddenness impossible for large birds or man-made planes.

Going from 25 miles an hour to a nearly instantaneous stop represents a miracle of mechanics; yet small birds do it with apparent ease. Any plane, automobile, goose, or flamingo attempting a similarly abrupt deceleration would find itself in a heap of pieces.

Inspiration to Air Pioneers

It is not surprising that S. P. Langley, the Wright brothers, and other pioneers of human flight studied bird movement, and that the gliding of birds was simulated long before serious thought was given to powered machines.

Of further footnote interest in studying the photographically frozen action of small birds is the vital role played by the legs in providing a leap at take-off and a cushion in landing. Such pictures also reveal the delicate angling of individual feathers or groups of them as ailerons, stabilizers, fins, and the like. By their use most small birds can bank, avoid, or stop with incredible efficiency.

Wholly different in behavior from small birds were the aracarís that arrived one day from South America. These grotesque members of the almost incredible toucan family have beaks which, although not as massive as that of the toco, are perhaps the more striking for their weird colorings (pages 84, 85).

Four of the newly arrived group had the experts stumped. Reference books were consulted and memories scanned. Never had this species passed through these hands. With narrow, reptilian eyes and witchlike aspect, they were strange birds indeed, and clearly too rare to hazard coaxing into flight action. I decided to settle for still portraits.

* See "A New Light Dawns on Bird Photography," by Arthur A. Allen, NATIONAL GEOGRAPHIC MAGAZINE, June, 1948, and the National Geographic Society book, "Stalking Birds with Color Camera," by Dr. Allen, with 331 color plates.



Flame-colored and Fire-eyed, the Cock-of-the-Rock Lands in New York

In the Bowery district stands the 5-story home of Louis Ruhe, Inc., a bird hostelry. Outside, trains of the Third Avenue elevated go roaring by. Inside, a thousand rare and fantastic birds chirp and squawk. Imported from the ends of the earth, they have been brought together for distribution to zoos and estates. Their concentration made possible this color series, which, if taken in the birds' native habitats, would have required years of work. True to his name, the **Cock-of-the-Rock** hails from a rocky canyon in Colombia (page 83).



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"Give Me Your Attention, Children!" A Pin-tailed Whydah Seems to Be Teacher as a Class of African Birds Concentrates on Geography
A Golden-breasted Waxbill in center peers over four males of the Red-checked Gordon Bleu, whose females lack the apple cheeks. Half off the page at left is a fifth, next to another golden-breasted waxbill. Breeding male Pin-tailed Whydahs (third and last two) develop tail feathers up to a foot long.

A Pigeon-sized Package of Coal, Ash, and Fire —the Cock-of-the-Rock

This flame-crested fellow with gleaming eye was caught in a baited net in Colombia. He is *Rapiscala peruviana*, one of two known species of **Cock-of-the-Rock** (page 81). The one not shown has a black rim around its crest. Drab and dowdy compared with the resplendent male, female and immature birds are russet brown.

Elaborate dances of males in jungle clearings were described more than a century ago by Sir Robert Schomburgk, German-English traveler. Few living men have seen this dance of the shy birds in their shadowy native haunts, the jungles and forests of northern South America.

Home is a nest of mud and grass plastered to a rocky ledge, preferably in a river gorge where fruit-bearing plants grow abundantly. There the raucous cries of the birds mingle with the music of water. With luck a future generation emerges from two eggs about the size of a pigeon's, dusky white with darker spots on the larger end.

A far cry from such surroundings is this particular cock's rock. It came from an excavation for building United Nations headquarters in Manhattan.

Rephotomicro by Paul A. Zahl





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♣ Strange "Scribblings" Adorn the Bill of the Lettered Araçari

Beak markings that look like written letters gave these Brazilian birds the first part of their name; the second part is a Tupi Indian word. Skilled acrobats, **Araçarís** can make long leaps from branch to branch with their wings closed.

✧ Unlettered Relatives Likewise Hail from Amazonian Jungles

Nature gave them distinctive haberdashery; hence their name, **Double-collared Araçari**. Like their kin (above) and other species of araçari—bright-colored tropical American toucans—they nest in hollow trees and eat mainly fruit.





85

Kodachromes by Paul A. Yell

♣ Loudly, Spotted-bill Toucanets Give Their Impressions of New York

Largest mouthful is being said by a female, whose rusty-brown dress contrasts with two males' formal attire. Toucan voices are about as musical as ripping canvas. On the bill of this species Nature has doodled a series of blots.

✧ Huge Yellow-red Beaks of Toco Toucans Can Mangle a Finger

Edges are sharp and raspy, but the ponderous-appearing bill is actually light, owing to an interior network of interlacing bony fibers. With their awkward-looking beaks South American **Toco Toucans** catch tossed bits of fruit with the deftness of a shortstop.





Two Tiny Feathered Australians—Gouldian Finch (Left) and Budgerigar—Delight American Eyes and Ears

Apt nickname of the Gouldian is "rainbow finch." It breeds in captivity—but in our winter, Australia's summer. Author Zahl and his 2½-year-old daughter, Eda, make friends with an Australian Grass Parakeet, or budgerigar. Occasionally "budgies" learn to parrot such phrases as, "I'm not bad; I'm just misguidel."

"What? No Flowers?"
Like Hummingbirds,
These Sugarbirds
Live on Nectar

On the under side of his wings one male shows the gold that gives the species its name—**Yellow-winged Sugarbird**. Drab-looking females are moss green and have less of the golden lining.

These little guests from tropical America act much like our hummingbirds. In flight they often hover, like hummingbirds and helicopters. Highly excitable, they thwarted photography again and again by beating against the glass that enclosed them. Homeland of the species extends from Mexico to Brazil.

Sugarbirds belong to the group known as honey creepers, which are small, usually brilliantly colored, and found only in tropic and subtropic America. The tongue has a bushy tip, perhaps to aid in getting nectar from flowers. Nests are well-built balls of rootlets and fine twigs lined with small roots and grass stems. The note is a feeble "Quit-quit."

Honey creepers have long been bred in captivity, but raising them is not easy.

Illustrations by Paul A. Zehl





Red-headed Finches from South Africa Banquet on Golden Heads of Millet

At home they roam dry savannas in flocks or pairs, feeding on ground seeds. Disdaining to build their own nests, **Red-headed Finches** lay their eggs in secondhand ones deserted by weaverbirds or sparrows.



✦ Eyes Right! New York's Attention Turns Four African Birds' Heads

Home to the Red-eared Waxbill is tropical Africa, but some members of this genus were brought to Puerto Rico, presumably on slave ships, long ago. The large round nest on the ground has a small penthouse on top, commonly called the "cock's nest."

✧ A Lavender Finch from West Africa Reaches for a High Note

"Redtail" is its nickname. Male and female look alike, except that the latter's under feathers are gray instead of black. Habits are similar to those of the red-eared waxbill (above), a shy bird of marsh, thicket, and cane field.





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Zebra and Fire Finches Live Thousands of Miles Apart

Desert travelers in Australia find flocks of **Zebra Finches** (left) as meaning water is near. **Fire Finches** are sparrow-common in parts of tropical Africa.



Birds of Many Words! Hill Mynas from Tropical Asia

Readily they learn to "talk." Keepers at the National Zoological Park in Washington taught a **Myna** to ask Congressmen, "How about the appropriation?"

Green Tiger Finches Belong to a Famous Family of Architects

Members of the group known as weaverbirds, these boldly striped "flying tigers" of central India share the family talent for building elaborately interwoven nests.

One relative, perhaps the most remarkable of the weavers, is the African sociable grosbeak. A hundred or even 200 pairs build their grass nests together in one tree, forming a gigantic mushroom-shaped mass—a veritable bird apartment house. Each nest is entered from below.

Green Tiger Finches weave a closed melonlike structure with a side entrance. The five or six extremely delicate pure-white eggs are well concealed at the bottom, on a lining of fine grass and down.

Like the other weaverbirds, these finches are small—about sparrow size. The female adult is less green-yellow than the male. Favorite haunts are near well-wooded places, among reeds and tall grasses. Note is a mere "Tap-tsip." Closely related to India's red munia, this species is sometimes called the green munia.

Illustrations by Paul A. Rahl





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↑ Exotic Tanagers Tackle the Fruit Course —One Has the "Breakfast Blues"

Though brightly colored, South America's **Golden** and **Blue-and-black Tanagers** would be outshone by that bird of fire, our own resplendent scarlet tanager. All tanagers are American. Their colors run a rainbow gamut. Four species breed in the United States.

↘ Another Bright Member of the Tanager Clan Is This South American Sunbeam

Called the **Mountain Tanager**, he comes from the northwestern corner of the neighbor continent, as do his colorful kinsmen above. More than 200 species of tanagers are known. Most hide their beauty in dark forests of Central and South America.





♣ **Stocky, Ungraceful Toucan-barbets
Need a Tailor and a Barber**

Bristles grow at the base of the bill; hence the name "barbet," from the French for "beard." Andean forest birds of Colombia and Ecuador, **Toucan-barbets** huddle motionless for hours, occasionally uttering harsh cries. Old World Tropics have relatives equally strange.

♣ **Troupials, or Bugle Birds, Can Be
Taught to Imitate Bugle Calls**

Easily trained, these striking fruit eaters are frequently kept as pets, particularly in their native Venezuela and northern Colombia. Often pugnacious, they are usually caged alone. The **Troupial**, a type of oriole, is active and jerky in its movements.





A Queen Whydah Bites the Hand That Feeds; a Violet-eared Waxbill Gets More Nourishment from Millet

Geography gave the **Queen Whydah** its name, from Whydah (Ouidah), in Dahomey, western Africa, whence the first of its tribe were shipped to Europe. From the Union of South Africa comes the **Violet-eared Waxbill**, an eater of insects as well as seeds. For privacy it nests in a thornbush.

Pests in Their Homeland, Pets Here, Cheeky Little Javans Endear Themselves to Americans

These **Java Sparrows**, or ricebirds, flew all the way from Indonesia to the Netherlands—by plane; then came to New York by boat. Farmers trap hundreds in Java, where they swarm around rice fields and villages. Male and female are almost indistinguishable, except by another ricebird.

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Illustrations by Paul A. Zahl





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Illustrations by Paul A. Ehl

♣ Though They're Not All of a Feather, Sociable Africans Flock Together

Crowding out a friend is a **Red-eared Waxbill** (page 89). Next, a **Melba Finch** from tropical Africa shows the public its profile. **Hooded Weaver Finches** (next pair) were taken to Puerto Rico, supposedly with African slaves, and now are common there.

✧ One of the Well-named Jewel Thrushes, a Chestnut-headed Pitta

This handful of gems comes from southeast Asia. **Pittas** live in forests, bamboo groves, or bushland, pursuing insects, worms, and snails and emitting a loud double whistle. The nest, near the ground, is a ball with a side entrance.



The largest photographic chamber was quickly set up. Howard was worried, for he was unacquainted with the temperament of these weird creatures for whose safety he was accountable. He knew that each bird was probably worth at least several hundred dollars and quite heavy enough to crash through the glass pane if excited.

The birds were carefully deposited in the chamber, the glass window lowered into place, and the curtain pulled aside.

We watched tensely as the four birds hesitantly mounted the heavy branch which extended through the center of the chamber. To our immense relief, instead of dashing to destruction against the glass they sat quietly squinting at us, moving their heads with the viscous fluidity of sleepy snakes.

After pictures had been taken and the birds removed, I saw Howard mopping his brow!

Rare Cocks-of-the-Rock Arrive

Great expectations were in the air the day we learned that a shipment of cocks-of-the-rock had just been put aboard a plane at Buenaventura, Colombia. This rare species was of special interest to me personally, for years ago in the mountain jungles of British Guiana I had caught brief glimpses of one flashing its golden-orange plumage through the deep tangle of foliage. Now at last I would have a chance to view the bird at hand range.

There were five males and two females in the shipment. Each was crated in a separate cage for reasons I was soon to learn.

I peered into one of the cages. On the crossbar sat an unimpressive russet-brown bird no larger than a wild dove. Its head was topped with just the suggestion of a crest.

Recognizing the bird as a female, I turned to the next cage. Instantly, through the crude wire-mesh front, my eyes caught the color of fire. Glaring at me was a male cock-of-the-rock in full plumage, a magnificent specimen of *Rupicola peruviana* direct from the Andean highlands.

With a great orange-red crest extending in a semicircle up over the forehead and nearly obscuring the beak, this beauty king of the bird world sat in unperturbed contrast to the uncleanness and disorder of the small shipping case. Even in confinement, Sir Coq de Roche bore himself with the mien of royalty.

Howard opened the wire-mesh front of the shipping boxes. Gently he removed each occupant and transferred it to more elegant quarters in a large private cage with multiple crossbars. Then came bearers of food and drink, who spread out a fruit banquet.

I did not wish to undertake photography until these fabulous visitors had rested; so it was not until three days later that we removed

two birds for study and photographs. The first picture was to be a close-up of Howard holding a male and a female (page 79).

These birds had already been sold to a Rubé customer for a large sum, and the management was allowing me to photograph them only under strictest orders that no harm come to the birds, that not a feather be ruffled.

I was busy focusing the camera when a sight in the ground glass sent a chill up my spine. I saw the male suddenly lunge at the female. With the speed and viciousness of a striking cobra, he drove his beak at her eye.

Fortunately he missed the primary target, but nevertheless succeeded in seizing a deep hold on the feathers and skin just below the eye. There his beak hung on like a vise, meanwhile screwing and digging with clearly murderous intent.

All this had happened in a flash. Through the ground glass I saw Howard pale and lose all signs of camera pose. He knew as well as I that the males can be vicious fighters and are fully capable of killing another male or a female. With a bird in each hand he was helpless. Had he released either one, things would have become even more complicated. Nor would the male ease its beak hold for another peck, which might have given the handler a chance to separate the birds. His only recourse was to tug firmly to prevent the bite from enlarging.

Only a Few Feathers Lost

By this time I had come to life and was leaping over to help disengage the clamped beak. Perhaps my sudden approach startled the killer, for he briefly relaxed his grip. In that instant Howard swept his arms apart, getting the birds out of reach of each other.

Miraculously, the female had lost but a few feathers and had suffered no extensive skin injury. With a little preening in the privacy of her cage, she soon reordered her head feathers and obliterated all signs of the attack.

Modern ornithologists recognize two species of cock-of-the-rock. One inhabits forests of the Andes and comprises four races. A second species is found in jungles from southern Venezuela and the Guianas to northern Brazil. Those photographed (pages 81, 83) are the Andean kind.

All cocks-of-the-rock appear to have one thing in common—they engage in elaborate dancing parties. South American explorers, coming across curious clearings in the deep jungle, learned that these were arenas in which these birds perform one of the weirdest ceremonies to be found in Nature. The arenas, only a few feet across, are clean and neat, divested of every trace of foliage.

One observer describes how the rites, mainly



Author Zahl Assembles Gear for a Camera Safari into Manhattan's Bowery

In his laboratory the naturalist affixes 200-mm. lens, light shade, and filter to the Leica camera aimed at the glass-paneled bird chamber on the table. Daughter Eda supervises. Dr. Zahl made his bird portraits in color (pages 81-96) with a variety of lenses at distances of one to 15 feet. He equipped the bird chambers, variously sized, with lights for 1/15,000-second flash speed (page 80).

in morning hours, are started by an old cock who suddenly flies down from a tree onto the bare clearing. There he begins leaping from ground to surrounding foliage, back and forth, back and forth, squawking, displaying his gorgeous wings, and fanning his tail feathers.

Other cocks, feeding above, apparently construe this to-do as an announcement that the dance is about to begin. They hurriedly fly down and enter the arena.

At first these newcomers just stand around and watch, but as the activities of the "caller" become more heightened and feverish, the spectators one by one leap into the center of the stage. They spread their wings, lift heads high, fan out their tails, all the while leaping, pouting, and squawking. When one dancer returns to the spectators' circle, another replaces him. Sometimes a number may be dancing simultaneously.

Suddenly the party breaks up and the dancers quietly return to their treetop perches.

Public interest in birds has made the search for rare exotic species a profitable and oftentimes big business. In addition, it has given rise to a flourishing industry—aviculture. The market for exotic birds is so considerable that large breeding establishments have developed in Europe and this country. Latest advances in nutritional and hygienic science are applied to propagation of birds from other lands.

But for every species that is adaptable to cage breeding, there are dozens which resist all coaxing to nest and lay eggs in captivity. There are many whose breeding habits are a complete mystery.

For this reason, the lone Indian or bush native still finds it profitable to catch those creatures of blue, yellow, green, and red that flock marsh and field and forest, those great-beaked creatures that inhabit jungle treetops.

So long as man is curious about his biological coinhabitants of the earth, he will seek to capture and display them for all to see.

20 Miles Aloft over Hudson Bay, Scientists Find Clues to Origin of High-speed Atomic Particles That Bombard Earth

BY MARTIN A. POMERANTZ

Leader, National Geographic Society-Bartol Research Foundation Cosmic Ray Expeditions

"STAND by to release!" Our six balloons, fastened together in tandem, were bobbing and straining at their ropes as we struggled to hold them against the chilling wind of the early subarctic dawn.

Bob Pfeiffer, one of my associates, held high the 15-pound gondola containing four Geiger counters which the balloons would carry into the stratosphere.

"Let her go!"

Balloon Train Takes Off

At the word, the balloons soared upward but also were carried along horizontally by the wind. Bob had to run with the precious gondola to make sure it did not drag on the ground before it was lifted clear.

Weary as I was, I felt a thrill of excitement. At last we were embarked upon our far-northern venture, on the trail of new facts about those mysterious messengers from outer space, the invisible but vastly powerful cosmic rays.

These rays are really atomic particles that constantly pelt down upon the earth from all directions at terrific speed. So great is their energy that they shoot right through the bodies of all human beings an average of 10 times a second and penetrate everything else on our planet as well. Some even plunge far down into the earth, to the bottoms of deep mines and beyond.

This unceasing bombardment has no known effect, either good or bad. But the energy of only one cosmic ray of the most powerful type is a billion times that released from a single uranium atom in the explosion of an atomic bomb.

Because they possess this enormous energy, cosmic rays are teaching us things about the atom that we could learn in no other way. Some atomic particles were first discovered when they were blasted out of atoms by cosmic rays. From this natural atom smashing we are learning much about the powerful nuclear forces that hold atoms together.

Here in the north we were hoping to find at least part of the answer to one great cosmic-ray question: Where do these mysterious particles come from? It was certain that their origin was far away from our planet, but just where was still unknown.

Though we did not know it then, luck was to be with us on our quest for the answer.

Under co-sponsorship of the National Geographic Society and the Bartol Research Foundation, we were to spend parts of two summers studying cosmic rays here on the bleak and lonely shores of Hudson Bay, at Churchill, Manitoba, once called "the town 500 miles from nowhere" (map, page 103).

Around us, to the north, west, and south, stretched the flat, swampy, lake-dotted muskeg, with Churchill's low wooden buildings almost lost in its vastness. To the east rolled the wind-whipped waters of Hudson Bay, barely above freezing temperature even on this August day, as we later quickly learned from an ill-advised venture at taking a swim!

Messages from the Sky

We watched our balloon train gradually disappear into the lonely, empty, subarctic sky. Then I went inside our crowded trailer laboratory, donned earphones, and listened intently for the automatically transmitted radio signals that should be returning to us from the Geiger counters as they were carried aloft.

Sure enough, the sounds were coming, strong and clear, an unevenly spaced "z-s-t, z-s-t, z-s-t," with a metallic overtone, like the spark of an old-fashioned telegraph key.

Those buzzing noises from out of the sky may not sound like the grand music of the spheres of which poets have sung, but they were true music to the ears of my associates and myself, for they were what we had journeyed 2,600 miles to the north to hear.

Each buzz was the "music," if you will, of a cosmic ray which had traveled, perhaps for thousands or even millions of years, from far off in the universe and was now impinging upon our balloon-borne Geiger counters.

As each ray struck the counters, a radio signal would flash back down to earth to be picked up by our receiver and cause a mark to be made on moving paper tape. We used some 50 miles of tape to record our data.

Rising rapidly into the stratosphere, our train of balloons soon would carry the counters to an altitude of more than 20 miles, where 99 percent of the earth's air blanket lay below.

Up there, practically at the "top of the atmosphere," in the cold silence where the air is highly rarefied, we wanted to obtain a count of the numbers of cosmic rays plunging toward us from outer space.



100

Courtesy of V. F. Hess

Balloons 40 Years Ago Proved Cosmic Rays Came from Space

Instruments carried up to 17,000 feet by Dr. Victor F. Hess of Austria in 1910 recorded a steady increase in the rays with altitude, showing they originated outside our planet and not in the earth, as previously believed (page 109). Here Dr. Hess, physicist and amateur balloonist, lands after a flight in 1912. He is now professor of physics at Fordham University, New York City.

From this we hoped to learn not only where at least some of the cosmic rays are born, but also some of the secrets they might reveal concerning the distant universe and the part they play in the structure of Creation.

Rays Travel Nearly at Speed of Light

Cosmic rays probably have been pelting down upon the earth for countless eons, but their presence was not even suspected until less than 50 years ago, and their true identity was not known until after World War II.

An estimated billion billion of them rush into the earth's atmosphere every second, traveling at nearly the speed of light, 350,000

times as fast as a bullet fired from the latest model U. S. Army rifle.

Some scientists have thought that the rays might be the atomic "dust" left over from a time some three billion years ago when, according to one theory, the universe came into existence through the explosion of a primordial super-atom, in which all matter had been concentrated.

Another theory was that the rays were the crumbling debris of a universe already beginning to disintegrate.

We now know that about 80 percent of the incoming rays are protons, which form the nuclei, or hearts, of atoms of hydrogen. Most of the others are alpha particles, the cores of helium atoms, plus a few nuclei of atoms of heavier elements such as iron and carbon.

Cosmic rays have far greater energy than X rays or any other known form of radiation. Physicists now think this energy may be supplied by fields of electric or magnetic force perhaps generated in our own great galaxy of stars, the Milky Way.

A highly simplified picture of what happens when a cosmic ray plunges into earth's blanket of air is that of a high-powered bullet striking a pile of marbles. It smashes atoms of air and sends the frag-

ments scattering in all directions, but mostly downward. The flying fragments pick up some of the terrific energy of the original particles and become secondary cosmic rays themselves. These particles in turn smash other atoms of air, and the debris from these again disrupts still others until all the initial energy has been dissipated.

These "second-hand" cosmic rays, formed in our own atmosphere, are the ones that reach earth's surface and penetrate our bodies.

The study of cosmic rays today is one of the most exciting new frontiers of science. One important reason for this is the scientist's love of gathering knowledge merely for the



Cruising Six Miles Aloft, This B-29 Measured Cosmic Rays from Canada to Chile

Carrying members of a National Geographic Society-Bartol Research Foundation expedition in 1946, the flying laboratory of the Army Air Forces made a series of flights over a course 4,800 miles long to determine how the intensity of cosmic rays varies with latitude. Dr. W. F. G. Swann (left), Bartol director, here discusses plans with Col. A. E. Key, the pilot, and Gen. Curtis E. LeMay, commander of the Strategic Air Command and a trustee of the National Geographic Society. The author took part in several of these trips.

sake of knowledge. This quest often leads to unexpected applications; X rays, radio, television, and the release of atomic energy are examples.

Another reason is that the energy of many of the primary cosmic rays coming in from outer space is far greater than any that man so far has been able to produce. The most powerful man-made atom smashers at present cannot accelerate atomic particles to energies comparable with those of the higher-energy cosmic rays. The rays provide us with a preview of what to expect as progress continues and we become able to attain higher and higher energies by artificial means.

Our balloon flights high into the atmosphere here in the north actually were only one small part of a world-wide attack on cosmic ray mysteries which is now being pressed by scientists of many nations. The rays are being studied on mountaintops, on other balloon flights, with rockets that climb 80 miles high,* at sea level, and underground.

Our expeditions also were part of a continuing study of cosmic rays sponsored by the National Geographic Society and the Bartol Research Foundation of the Franklin Institute

* See "Seeing the Earth from 80 Miles Up," by Clyde T. Holliday, NATIONAL GEOGRAPHIC MAGAZINE, October, 1950.



Samuel Hearne's Name, Carved in 1767, Calls to Mind a Famous Arctic Trek

As a Hudson's Bay Company agent seeking copper mines reported by the Indians, this intrepid Englishman in 1770-72 roamed 1,000 miles northwest of Hudson Bay, discovered the Coppermine River, and followed it to the Arctic Ocean. He found copper deposits but no mines. Hearne later became governor of Fort Prince of Wales, built near the present site of Churchill, Manitoba, between 1733 and 1744 to protect the company's fur trade (page 113). He made the inscription at Sloop Cove, near Churchill, before his trip to the Arctic.

since 1934. Some of the first photographs of cosmic-ray tracks recorded in the emulsions of photographic plates were made on the stratosphere flight of the balloon *Explorer II* in 1935.* This program has been supervised by Dr. W. F. G. Swann, director of the Bartol Foundation, and our Hudson Bay expeditions benefited much from his wise counsel and active support.

Before our trips to Churchill, I myself had taken part in this program on the solar eclipse expedition of The Society and U. S. Army Air Forces to Brazil in 1947;† on the 14,260-foot summit of Mount Evans, Colorado; and on a series of research flights by a B-29 "flying laboratory" of the U. S. Army Air Forces measuring cosmic rays up to altitudes of 30,000 feet between Canada and Chile (page 101).

Our immediate objective here at Churchill was to study how cosmic rays are deflected in their flight by the earth's field of magnetic

force which makes the compass needle point north. This magnetic field extends for thousands of miles out into space around our planet, far beyond the atmosphere. At the same time we planned to investigate the widely held theory that the sun has a similar magnetic field which would deflect some cosmic rays coming from far outside the solar system so that they could not reach the earth at all.

Earth's Magnetic Field Deflects Rays

The earth's magnetic field deflects cosmic rays approaching our planet in inverse proportion to the energy they possess. This deflecting power is smallest at the north and south geomagnetic poles (not the same as the magnetic poles) located in Greenland and

* See National Geographic Society CONTRIBUTED TECHNICAL PAPERS, Stratosphere Series Vol. 1, No. 2, p. 37 et seq.

† See "Eclipse Hunting in Brazil's Ranchland," by F. Barrows Colton, NATIONAL GEOGRAPHIC MAGAZINE, September, 1947.

Antarctica, and greatest at the geomagnetic equator halfway between.*

Our planet's magnetic field thus serves as a sort of filter, which permits only the strongest cosmic rays to come through where its deflecting power is greatest, while weaker and weaker rays are able to penetrate as the field's influence diminishes toward the north and south. It is like a steel plate that is thick in the center but grows thinner and thinner toward the edges, and at which are being fired bullets traveling at many different speeds. Only the fastest bullets can penetrate the plate in the center, but those with less and less speed are able to go through as they strike nearer and nearer the edges.

Many television picture tubes make use of this same principle by employing a magnetic field to control the paths of electrons in the electron beam that produces the picture. Turning the focusing knob on a set of this type regulates the magnetic field.

Because of this filtering effect of the earth's magnetic field, more rays penetrate it at the latitude of Swarthmore, Pennsylvania, our headquarters at the Bartol Research Foundation, than farther south at the geomagnetic equator. Now we wanted to see if still more rays were coming through farther north at Churchill.

On the Trail of a Discovery

If we found more rays coming into the atmosphere here, the additional ones would be weak rays that could penetrate the earth's magnetic field only at higher latitudes. Should we find these weak rays coming in, we would have an important clue to where some of the cosmic rays come from and to conditions out in space controlling their flight toward the earth.

This very first balloon flight might give us the answers we were seeking. I listened in-



Drawn for Robert Northrup and Irvin E. Allen

Northern Skies Gave Clues to Cosmic-ray Origins

Over Hudson Bay the author discovered rays traveling earthward with such low energy they could have come from no source farther away than the sun. Cosmic rays of this type can penetrate earth's magnetic field only near geomagnetic poles. None but high-energy rays pass through at geomagnetic equator.

tently to the buzzing sounds coming sharp and clear in my earphones.

"The signal strength seems remarkably high," I said to my assistant, Bob Kerr, at the radio receiver controls. "What was the last indication of the balloon train's altitude?"

"About 60,000 feet," he said, "and rising 250 feet a minute."

"Let's make another check on the number of signals per minute," I said. "If particles too weak to enter the atmosphere at Swarthmore are getting through here, some of them should be penetrating down to where the balloon train is now."

After listening for about 10 minutes and marking down each signal as it came, I began to realize with rising excitement that the buzzing sounds were coming about 20 percent

* See diagram on page 680 in "Unlocking Secrets of the Northern Lights," by Carl W. Gartlein, NATIONAL GEOGRAPHIC MAGAZINE, November, 1947.



▲ Cosmic-ray Balloons Are Inflated with Hydrogen, Then Fastened in Tandem

The author (left) fills a bag with gas from a steel cylinder. The tent protects delicate fabric from buffeting by the winds (page 113).

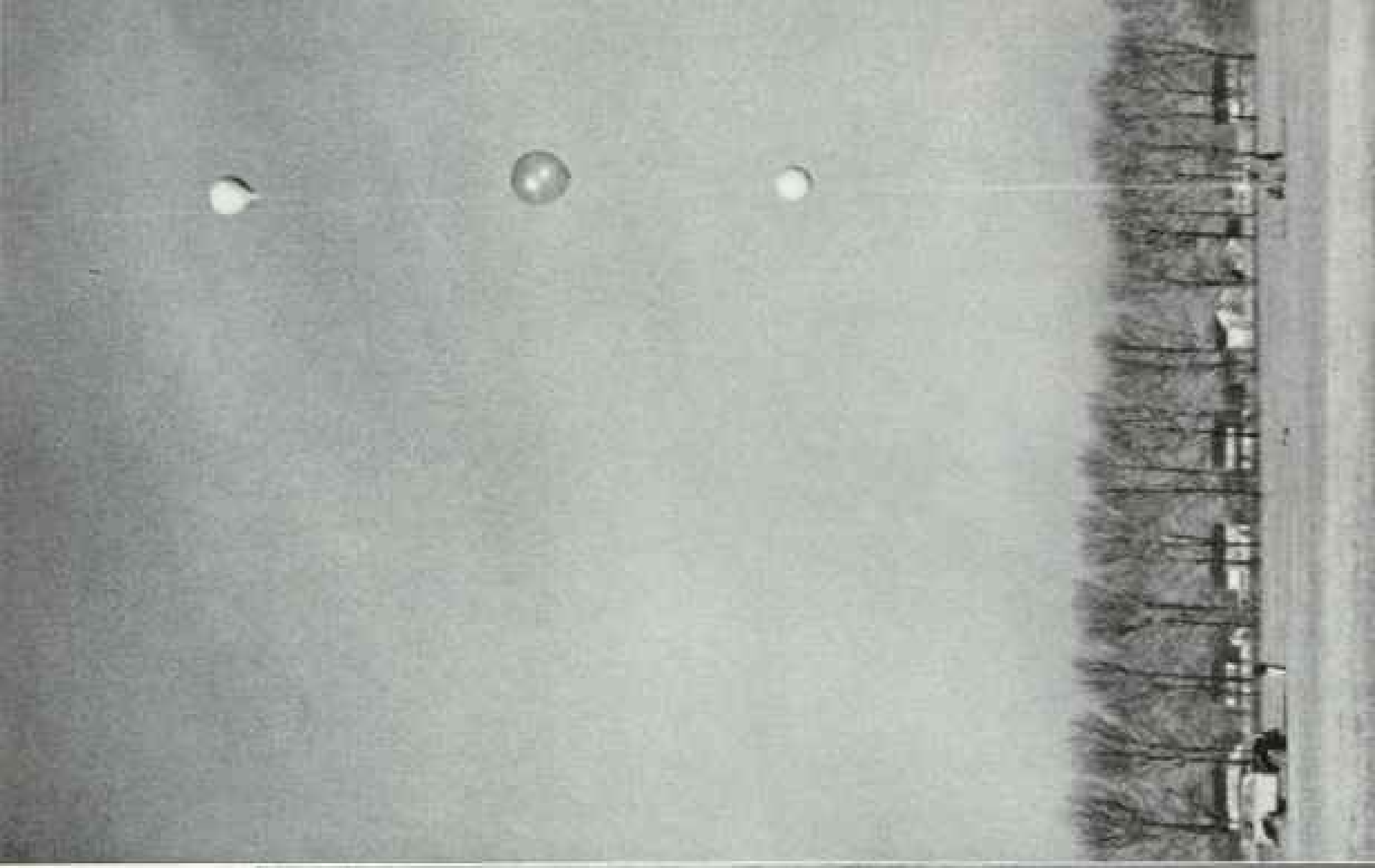
→ A train of balloons strains at its moorings before take-off at the Swarthmore, Pennsylvania, headquarters of Bartol Research Foundation. Similar trains were used by the Hudson Bay expedition.

✦ Radio Signals Received on the Ground Give a Count of Cosmic Rays Aloft

Expedition scientists in their trailer-laboratory record impulses relayed to earth when rays from outer space strike Geiger counters carried 20 miles high by a balloon train (page 99). The author (seated) checks figures, Edward Swaffer (left) watches the recording of signals on paper tape, and Dr. Gordon McClure adjusts the radio receiving equipment.

Continued Defiance Research Fund

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A Microscope Shows How Cosmic Rays Smash Atoms

Physicist Swann studies a "star" (as on opposite page) produced on a photographic plate by a cosmic ray's impact on an atom in the emulsion. An enlargement of a similar collision is shown at his right. The study of cosmic-ray bombardments aids the understanding of powerful forces holding nuclei together.

faster than they did at Swarthmore. Unless the increase was a freak one, it looked as if we already might be on the track of what we were seeking.

We decided to check the count by hand for the entire duration of the flight. This would tell us what was happening much more quickly than going back over the data recorded on the tape, though the latter of course provided a check on our hand counts.

During the next five hours, while the balloons attained the altitude of 105,000 feet and then descended, we thought only of cosmic rays. We completely forgot that we had had nothing to eat for the past 18 hours and had spent only a restless hour and a half in our sleeping bags the previous night, disturbed by the unearthly howls of Eskimo Husky dogs chained near by.

Only after our data on this first flight had been plotted in the form of a graph, which we could compare with a similar one based on

flights at Swarthmore, were we convinced that we actually had found an increase in the number of cosmic rays. Then we took time out for a modest jubilation.

Our findings meant that we had discovered a group of cosmic rays never before detected or studied, rays of comparatively low energy, which could penetrate the earth's magnetic field only at high latitudes.

We also had strong evidence that the sun had no magnetic field that could be detected by present methods. If such a field existed, it would have deflected away from the earth the weak cosmic rays we had found coming in at the top of the atmosphere.

Some Cosmic Rays Born on Sun

More important still, our discovery was a step toward solving the mystery of the origin of at least some cosmic rays. Further study by ourselves and other researchers eventually showed beyond doubt that these weak rays

must be born in the sun, for this type does not have enough energy to have enabled them to travel from more distant parts of the universe.

To confirm the exciting results of our first balloon flight we needed to send up many more. We would have to work fast, for already the town's short two months of summer were more than half gone, and the onset of winter in September was only three weeks away. Churchill averages only 60 days between the last frost in spring and the first in the fall. In this harsh north country Nature makes literally true that old joke about some of our northern States: "Ten months of winter and two months of late fall!"

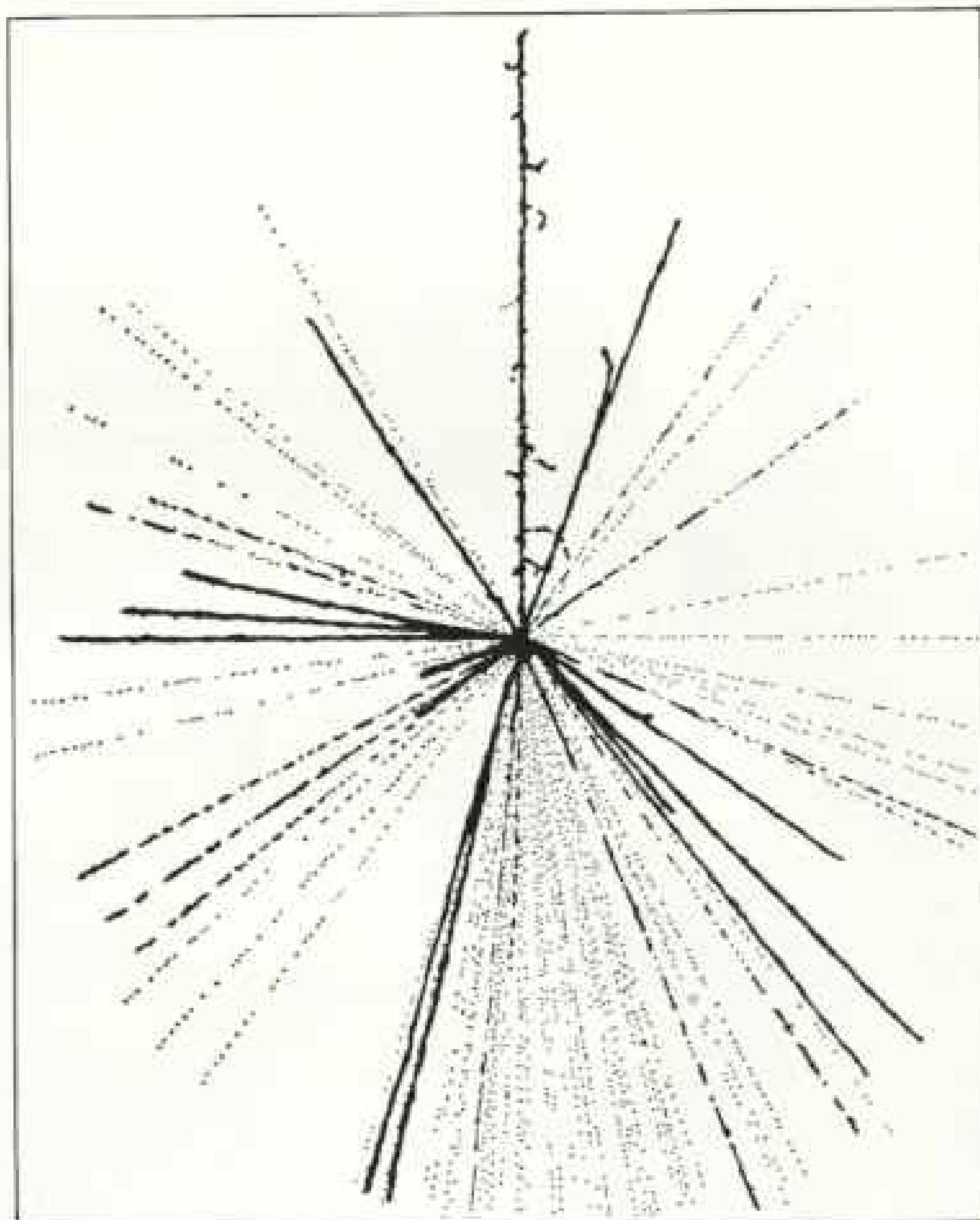
The ensuing days were both action-packed and thrilling, as flight after flight continued to show the increased counts of cosmic rays at the top of the atmosphere in this northern latitude.

Our daily routine was hectic and fatiguing. Sleep was purely incidental. We rose in the dead of night to prepare for a launching of balloons at dawn, when the wind usually was at a minimum (page 110).

First, each balloon would have to be boiled for about 10 minutes in a large copper laundry tub to decrystallize the neoprene fabric, a synthetic rubberlike plastic. Otherwise, the balloons would have burst prematurely, for the material tends to become brittle as a result of aging and exposure to cold.

If the wind was light and no rain threatened, inflation would begin.

It took two or three hours to inflate the 6 to 12 balloons. The amount of gas in each had to be adjusted with great care so that the train would rise rapidly to 40 or 50 thousand feet, where two balloons would burst. Then the others, with their gas gradually expanded



Eric Pickup

Fragments Fly When a Ray Strikes an Atom

This picture, greatly magnified, was produced when a cosmic ray (coming down from top center) demolished an atom in the emulsion of a photographic plate carried aloft by balloon. Flying particles made the emulsion grains developable, just as light would do, so that the phenomenon took its own picture. Properties of the fragments are indicated by the nature of their tracks. Fragments of atmospheric atoms smashed by cosmic rays from outer space acquire some of the terrific energy of the original particles and become secondary rays.

by the heat of the sun, would carry the instruments more slowly up through the higher atmosphere into which low-energy cosmic rays can penetrate.

Finally, at about 100,000 feet, one more balloon would burst. The remaining ones would not have quite enough lift to keep the gondola aloft, and the train would then descend.

First Balloons, Then Breakfast

Not until the train was successfully launched could we stop to think of breakfast. Then, while one man cooked the meal, the other two would adjust the radio receiver and start the recording tape working to pick up the signals that immediately started coming in.



Head Nets and Heavy Clothing Ward Off Hungry Mosquitoes and Biting Winds

Attacked by swarms of the insects, expedition members had to do without mosquito lotion because, rubbing off on contact, it disintegrated the neoprene fabric of their balloons (page 113). Here Robert Pfeiffer and Robert Kerr take shelter from August's cold in the trailer-laboratory used the first year at Churchill.

Flights usually lasted from 6 to 12 hours, and we had to stand by constantly to make sure that things were working right. Now and then during the day we would take turns at eating and snatching a few winks of sleep.

The Geiger counter, which was the heart of our cosmic-ray detecting apparatus, is essentially a gas-filled tube in which a tiny spark is produced when an atomic particle, such as a cosmic ray, passes through it. This electrical discharge can be made to send out a signal each time a cosmic ray penetrates the counter.

Counted Only Rays from Vertical

In these experiments we were interested only in counting those primary cosmic rays which travel down vertically as they come in from outer space. Therefore we rigged our four Geiger counters one below the other like the rungs of a ladder, so that only the rays com-

ing down vertically would pass through all four of them. The counters were connected in such a way that a ray had to trigger all four to send out a radio signal.

Another radio signal told us the altitude of the balloon train from time to time, automatically reporting the readings of a barometer which responded to the decrease in atmospheric pressure as the train rose aloft. The pitch, or frequency, of this same signal also indicated the temperature inside the gondola, through a hookup with an electrical resistance thermometer. As long as the pitch did not vary, we were assured that the apparatus was being kept at its proper operating temperature of about 70° F.

Each gondola was enclosed in two or three Pliofilm bags which acted like a greenhouse, trapping the heat of the sun and then preventing it from escaping. Otherwise, in the

severe cold at high altitudes the batteries that powered our apparatus would freeze. All the equipment for our balloon flights was supplied by the Office of Naval Research.

On some of our first flights we also sent up photographic plates which would "photograph" what happens when a single cosmic ray smashes an atom of silver or bromine in the emulsion. We soon gave up this practice, however, because it proved to be impossible to locate the balloon trains that had returned to earth in the impenetrable muskeg.

Rays Discovered by Accident

As I watched our balloon trains take off day after day, I often thought of Dr. Victor F. Hess, the Austrian physicist who first was able to prove that cosmic rays come from outer space. He himself was an amateur balloonist and took detecting instruments aloft in a balloon to make his discovery (page 100).

As has happened so often in the history of science, cosmic rays were first encountered by chance. Certain laboratory experiments were going mysteriously wrong. Instruments believed shielded from all known forms of radiation still indicated that some was present.

Radioactivity in the earth's crust seemed a likely villain for a while, particularly after an apparatus, carried up several hundred feet in the Eiffel Tower in Paris, showed a small decrease in detectable radiation.

The first true light on the subject came in 1910 when Professor Hess took his instruments aloft to 17,000 feet in a balloon and found that the puzzling activity intensified at higher altitudes as the balloon ascended.

Hess ascribed this to the presence in the atmosphere of a radiation having very great penetrating power and originating somewhere out in space. His epoch-making flight was the start of cosmic ray research and ultimately won for him a Nobel prize in physics.

Railway to the Subarctic

We had chosen Churchill, some 500 miles south of the Arctic Circle, for our cosmic-ray observations in the subarctic because it was the farthest-north point to which we could easily transport the truck and trailer that carried our equipment and the 175 heavy steel cylinders of hydrogen gas used to inflate our balloons.

Churchill is the most northerly railroad station in Canada connected with the main transcontinental rail system. The railroad, extending 510 miles from The Pas, was built to provide access to a seaport on Hudson Bay which brings Canada's wheat-growing Prairie Provinces about 1,000 miles closer to Britain and the Channel ports than Montreal. Thus grain can be shipped from Churchill at a consider-

able saving in transportation costs (page 111).

A tall grain elevator of 2,500,000 bushels' capacity, operated by Canada's National Harbours Board, rises starkly above the surrounding muskeg. It has equipment for dumping carloads of grain and an elaborate system for cleaning, grading, and loading wheat by conveyor belt. Three vessels can be loaded at once. Grain ships use the port only about two and a half months a year because ice in Hudson Strait makes navigation dangerous at other times. Also minimum insurance rates prevail only between July 23 and October 10. Grain shipments in 1952 totaled about 9,000,000 bushels.

No highways lead to Churchill. The railroad runs through forest and across swampy muskeg, and much of the line is built over permanently frozen ground. We drove our truck and trailer to The Pas, 400 miles north of Winnipeg, then loaded the vehicles on a flatcar and made the 21-hour rail trip in a comfortable Pullman sleeper. Trains run twice a week the year round. The roadbed, elevated slightly above the surrounding country, is kept clear of winter snow by the almost ceaseless winds blowing off the tundra.

Into the "Land of Little Sticks"

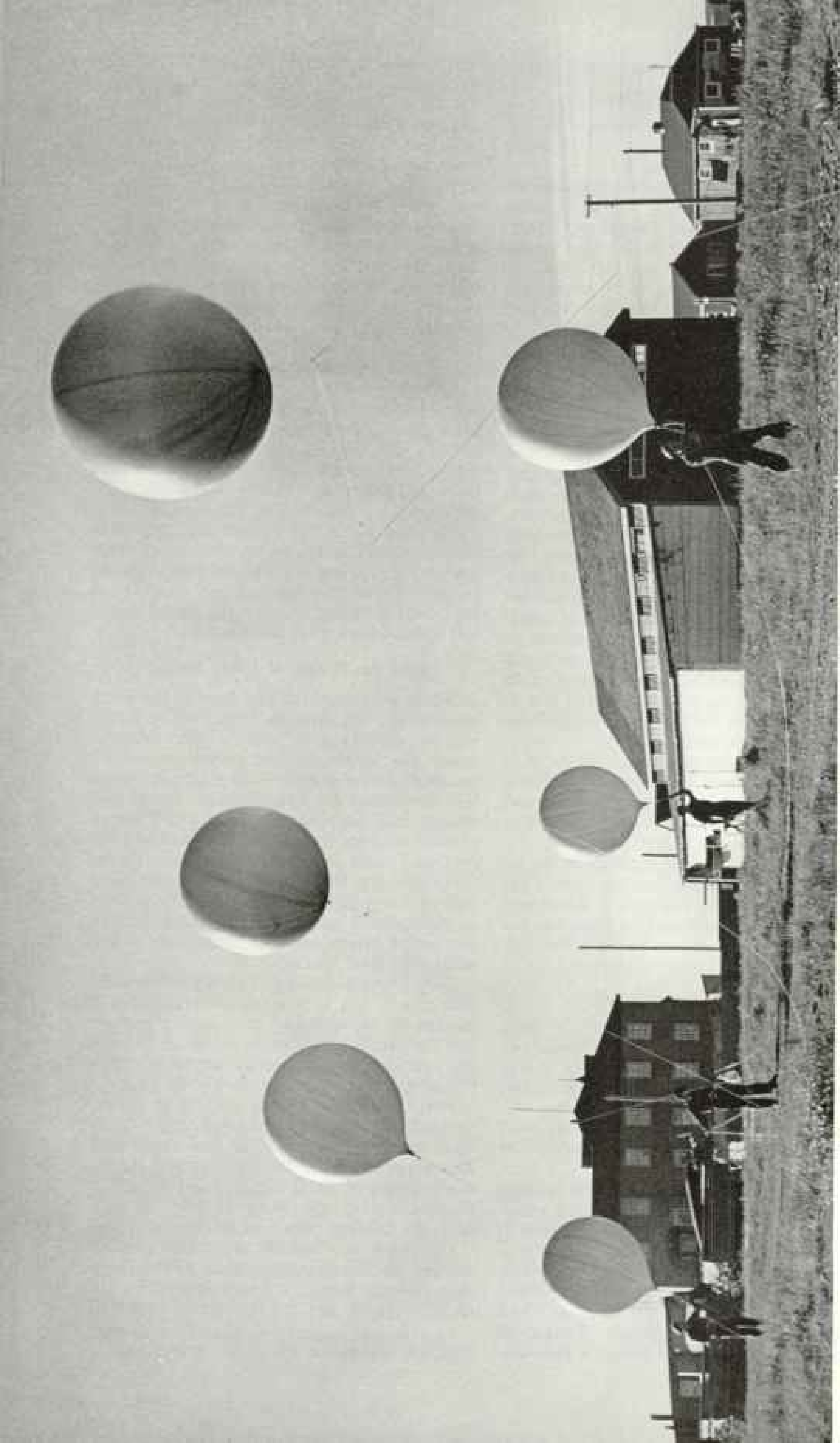
When we retired to our berths, the train was still moving through forest, but by morning we were in the "land of little sticks," where the woods dwindle down to stunted, scattered, dwarf growths and gradually merge into the almost treeless muskeg. Farms and villages had disappeared. Only a few houses of track workers or cabins of Indians and trappers gave signs of human habitation. To the northwest are the vast, almost unpopulated Barren Grounds, where hundreds of thousands of caribou still wander. Their fall migration southward brings some of them only a few miles west of Churchill.*

Only about 830 people live in Churchill the year round, but in summer its population is swollen by the influx of construction workers and the people who operate the grain elevator and docks. A commercial airline operates planes to the town twice weekly all year.

Fort Churchill, near the town, is an important military outpost, garrisoned by the Canadian Army and Royal Canadian Air Force. As compensation for the isolation and the increased cost of living for married men with families during the two-year tour of duty here, the military personnel receive extra pay.

Our work at Churchill was made possible through the friendly cooperation of the Canadian Defence Research Board, headed by Dr. O. M. Solandt, and the director of its Arctic

* See "Canada Counts Its Caribou," 13 illustrations, NATIONAL GEOGRAPHIC MAGAZINE, August, 1952.



Balloons Strain at the Lash Before Launching into the Stratosphere with Cosmic-ray Counters

Scientists at Churchill prepare to release an unwieldy train soon after dawn, when wind is lightest. Each bag is inflated with a measured amount of gas, which expands as the train rises. Two balloons will burst halfway up, slowing ascent. When a third bursts at 20 miles, destroying lift, the train will settle to earth (page 107).

Winter Turns Swampy Muskeg into a Highway

Ice and snow make travel easy in country which in summer is so wet and marshy that it is almost impassable. Winter temperature here has dropped as low as -57°F . This Indian's dog team, hauling a sledload of supplies, sets out from Churchill to trap furs. Later the trapper will trade them at the Hudson's Bay Company store (page 115).

Canadian National Railways



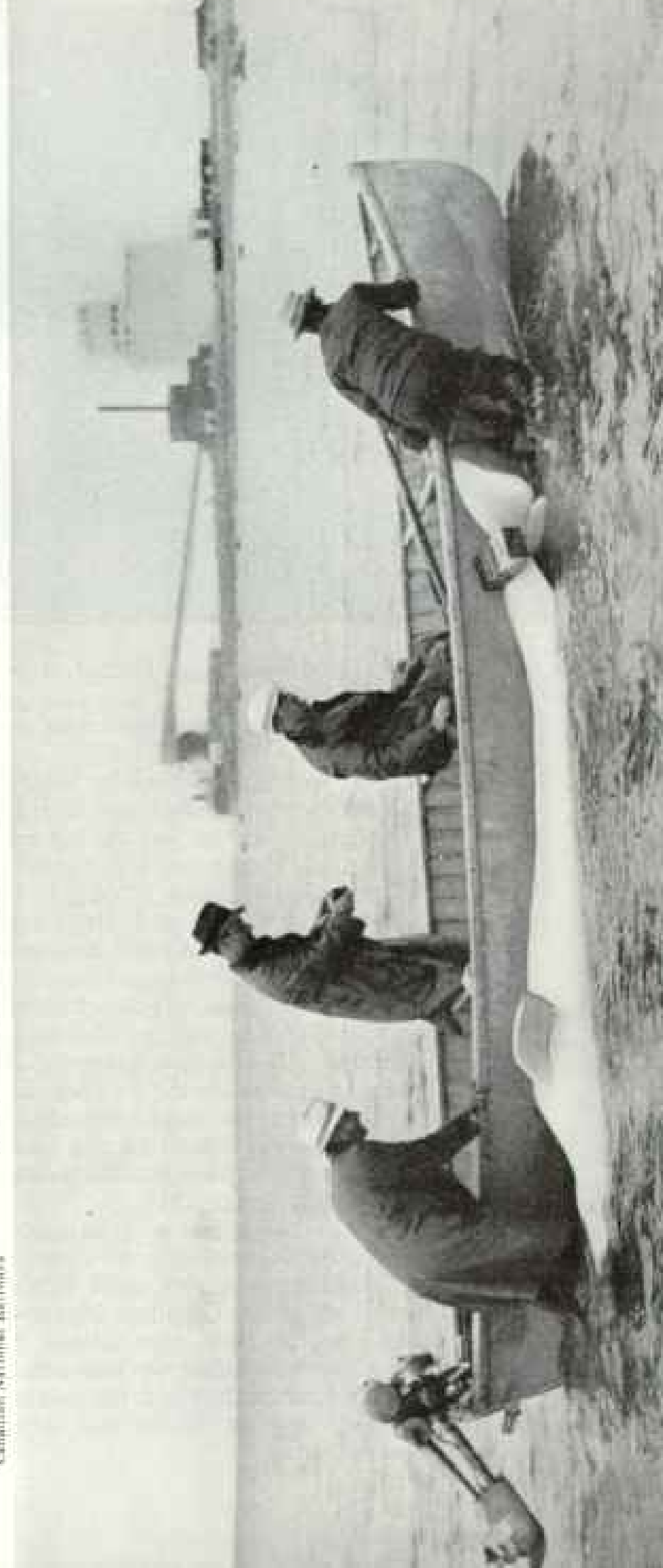
Canadian National Film Board

White Whale Hunt Is Summer Sport in Churchill Harbor

The white whale, or beluga, is 12 to 14 feet long. Its oil is exported, and the meat is used for dog food.

These hunters bring in a whale harpooned from a small boat (page 111).

Distant elevator and docks ship wheat from Canada's Prairie Provinces during Churchill's short ice-free summer. The elevator's capacity is 2,500,000 bushels.





Expedition Members Stack Cylinders of Hydrogen Gas for Inflating Their Balloons

Bartol Foundation's trailer served as both laboratory and living quarters the second summer at Churchill. Wind-speed and direction instruments showed when balloons could be safely launched.

Division, G. W. Rowley. Especially helpful were the scientists who headed the Board's Northern Laboratory at the fort during our two visits, Dr. Guy Marier and Dr. Kenneth Fisher, and the administrative officer, A. V. Hannum. Dr. Eric Pickup and Dr. Louis Voyvodic of the Canadian National Research Council took part in our first expedition.

Occasionally we had time to watch hunters harpooning and shooting white whales in Churchill's harbor. The whales, generally 12 to 14 feet long, appear when the ice goes out. Their oil is exported, their steaks are edible, and the rest of the meat is used for dog food. A processing plant at Churchill handles almost 600 carcasses a year (page 111).

Churchill has a movie house, post office, bank, Hudson's Bay Company general store, a few small trading posts, two small hotels, and a station of the Royal Canadian Mounted Police. But alas for our expectations of glamour! We found that their workaday uniforms are an unromantic drab and the famous red coats appear only at dances and other special occasions.

Churchill's average July temperature is only 53.7° F., and in January the average is 19 below zero. The lowest temperature on record is 57 below, and the highest 96. In mid-December the sun does not rise until nearly 9 a. m. and sets again soon after 3.

Wind Chill Causes Quick Frostbite

Churchill holds the dubious distinction of being a place where wind chill can cause frostbite more quickly than almost anywhere else on earth. Wind chill is the result of a combination of wind and low temperature, which removes body heat faster than it can be replaced. Because of this, many of the buildings at Fort Churchill are connected by enclosed passageways to minimize the need for going outdoors in winter.

The wind and the severe cold make this area an ideal place for testing military winter clothing and equipment. Both Canadian and United States forces use it for this purpose.

One bearded trapper told us, with a twinkle in his eye, how he once turned these maneuvers to his own advantage. A column with mech-

anized snow-traveling equipment halted at his cabin for directions for reaching a rendezvous point.

"Now," confided the trapper, "I figured anybody abroad in these parts in the dead of winter ought to be able to find his own way. So I gave them a bum steer. I don't know whether those soldiers ever got where they wanted to go, but they sure cleared and packed down the neatest path through the snow I've ever had along my trapping lines!"

Gateway to the North

Churchill also is the jumping-off place for points farther north. From here ships, planes, and dog teams carry supplies and personnel to Hudson's Bay Company trading posts, mining camps, and missions.

Roman Catholic and Anglican missions are maintained in Churchill. Father Jean Philippe showed us his little chapel in which the altar mural depicts Christ instructing His disciples to carry the Gospel to the world, and modern missionaries setting forth with dog teams to carry out this instruction in the far north in winter.

The 30 missions of the Oblate Fathers have their own dog teams and in winter range far to the north over a vicariate that covers a million square miles, preaching to some 5,000 Eskimos in the area. One priest, left with only meager supplies when a mission plane was wrecked, spent six months out of touch with white people, living with the Eskimos and killing fish and game for food.

Churchill is famous among ornithologists because of its concentration of birdlife typical of both the Arctic and the forested areas just to the south. Near by can be found nests of the Arctic tern. Every year some individuals of this species migrate 22,000 miles to the Antarctic and back by way of Europe and Africa. Here, too, nests the golden plover, also a long-distance migrant, which goes as far as southern Argentina and back again.*

Mutineers Cast Hudson Adrift

In 1610 Henry Hudson, the famous Englishman who sailed for the Dutch, explored the vast inland sea on which Churchill now stands. Somewhere on those same misty waters a mutinous crew later cast the explorer adrift in a small boat to perish.†

Still later, fur traders of England's Hudson's Bay Company built, near the present site of Churchill, Fort Prince of Wales, the most northerly fortress of its type ever constructed in eastern North America. Its walls, partly restored, are from 37 to 42 feet thick.

It was from here that Samuel Hearne, one of the great explorers of Canada's early days, journeyed 1,000 miles northwestward into the

unknown interior of the continent in 1770-72 to look for the Northwest Passage and for copper mines reported by the Indians.

He found little copper, but discovered the Coppermine River and followed it to the point where it flows into the Arctic Ocean. Hearne traveled on foot and by canoe, guided by friendly Indians, lived on fish and game, and at times suffered severely from hunger.

One of the chief handicaps in launching our balloon trains was the unceasing wind which blows across the level tundra. The winds are so strong at times that telegraph poles are erected in the form of tripods, a method which also makes up for the lack of a firm foundation in the swampy muskeg. Branches of the few dwarfed trees which manage to survive in this barren land usually grow on the lee side. To make a symmetrical Christmas tree, Churchill residents cut two trees and tie them together.

For protection, we inflated our balloons inside a shelter so they would not be dashed to the ground and broken before taking off (page 104).

Winds Often Blew Down Tent

Often the winds, accompanied by heavy rains, blew down the tent we used for inflation the second year. Erecting it again was made more difficult by the fact that the subsoil was permanently frozen, in some places no more than a foot below the surface. Wooden tent stakes were useless. We had to drive long iron stakes into the frozen soil with a sledge hammer. In addition, iron pipes were lashed to the stakes and the lower edges of the tent secured to them; several dozen heavy hydrogen tanks served as additional anchors.

Mosquitoes, too, in a way most devious and at first unsuspected, interfered with our balloon flights. Their attacks were most voracious when the winds were gentle, which, of course, was also the best time for launching balloons (page 108).

When the mosquitoes raided us in force, we daubed liberal applications of mosquito "dope" on all exposed parts of our bodies in order to make the balloon launchings bearable. Then we began to notice that at such times the balloons occasionally did not rise as high as expected.

Finally my associate, Gordon McClure, found the unhappy answer. When the mosquito repellent rubbed off our fingers on a balloon, it weakened the synthetic rubber. The balloons would burst prematurely and

* See "Birds of Timberline and Tundra," by Arthur A. Allen, NATIONAL GEOGRAPHIC MAGAZINE, September, 1946.

† See "Henry Hudson, Magnificent Failure," by Frederick G. Vothburgh, NATIONAL GEOGRAPHIC MAGAZINE, April, 1959.

not rise to the desired height. So we had to operate without benefit of mosquito dope, at the mercy of the famished hordes.

In contrast, one laughable episode highlighted our stay. To help alleviate the dullness of life here in the far north, a movie was shown every Sunday night in the lounge at the Fort Churchill officers' mess, usually preceded by a short talk by one of the many visiting scientists on his particular project. Since much curiosity had been aroused by the balloons rising from an area posted as "out of bounds to all ranks," I was asked to talk about cosmic rays.

At dinner before the program, I happened to sit next to the amiable head nursing sister of the garrison hospital. She did not know my name. Never suspecting that I was the scheduled speaker that evening, she advised me that it would be wise to come early to the lounge so as to obtain a soft, comfortable chair before the lecture.

"This," she admonished, "makes the whole thing much more bearable, and, in fact, you can even fall asleep without being detected!"

"Yes," I replied, "this seems to me to be especially important this evening. I fear this lecture will be horribly dull at best."

Cosmic Rays No Beauty Aid

When my lecture was about to begin, I saw that my friend had indeed succeeded in obtaining a comfortable chair, and she seemed to be trying to sink lower and lower in it with every word of the commanding officer's introduction of the speaker of the evening!

The audience was flatteringly large, and I was especially impressed by the large turnout of ladies. Only later did I discover that most of the women at the fort got news of the lecture topics by word of mouth. Someone had passed word that my talk was to be on "*cosmetic rays*!"

Strangely enough, perhaps the most thrilling discovery connected with our expeditions to Churchill was not made until after we had returned home. It provided indisputable evidence that some cosmic rays do originate in the sun and that sometimes they travel from there to the earth in a short time.

While going through the records of a balloon flight made at Swarthmore before we went to Hudson Bay, I found that the Geiger counters had recorded a 15-percent increase in the number of cosmic rays at heights of 95,000 to 100,000 feet, compared to what was normally observed on flights reaching that altitude.

This particular flight had reached its ceiling approximately 19 hours after the start of a very intense eruption that astronomers had seen on the surface of the sun. During the

period when our instrument was aloft, an unusual increase in solar radio noise also was detected by the Cornell University Radio Astronomy Observatory. Outbursts on the sun often cause an increase in such noise.

Rays Linked to Solar Eruptions

This was the first instance of a simultaneous correlation between a disturbance on the sun and the cosmic ray intensity near the top of the atmosphere. At lower altitudes no increase in cosmic rays was observed, because the particles emitted by the sun at this time possessed too little energy to penetrate deeply into the earth's blanket of air.

Dr. Lyman J. Briggs, chairman of the National Geographic Society's Research Committee, inspired a program to follow up this discovery, enlisting the aid of several scientific institutions.

Whenever possible, cosmic ray counters were sent aloft when violent outbursts of activity were noticed on the sun, and often it was found that an increased number of rays were arriving. This further confirms that the sun is a point of origin of many of these rays.

Our second summer's expedition to Churchill was chiefly concerned with learning more about the new cosmic rays of low energy that we had discovered the first year and checking on our findings about the sun's lack of a magnetic field. On this second trip I was accompanied by Gordon W. McClure and Edward Swoffer of the Bartol Research Foundation.

We wanted to make sure that there was no variation in the number of cosmic rays coming into the top of the atmosphere at different times of day. If there had been, this would have been another indication that a strong magnetic field exists on the sun. We found no signs of such a field. All our balloon flights the second summer, made at various times of day, showed the same number of cosmic rays arriving at the top of the atmosphere.

On some of the balloon flights we inserted plates of lead between the Geiger counters, to learn how much of this material the incoming cosmic rays could penetrate, a key to the amount of energy they possessed.

"Skyhook" Balloons Up 22 Hours

We also sent up ionization chambers which record the smashing of atoms in the walls of the chamber by incoming cosmic rays. This provided useful information on how cosmic rays disintegrate the nuclei, or cores, of atoms and release the energy that is locked up within them.

To supplement the things we learned at Churchill, we sent up our instruments later



Furs Buy White Man's Clothes for Indian Children in a Hudson's Bay Company Store

Pelts taken on trap lines during the subarctic winter are carried to Churchill in spring and traded for a year's supplies at the general store. Operating originally under a charter granted by the British Crown, the Hudson's Bay Company has been trading for furs with Canadian Indians and Eskimos for more than 200 years. One of its first posts, defended by a strong fort, was established near the site which became Churchill.

from Minneapolis, Minnesota, on a flight which stayed at high altitudes for 22 hours, using the giant plastic balloons developed by Project Skyhook, sponsored by the Office of Naval Research at the General Mills Aeronautical Research Laboratory.

Rays May Wander 10,000 Years

During the entire duration of this flight, nearly a full day and night, our instruments registered no change in the number of cosmic rays coming in at high altitudes. Surprising as it may seem, the number of incoming rays reaching a given point on the earth is the same at night when that point is turned away from the sun as during the day when it is turned toward it. One might expect that if the rays come from the sun, more would be picked up during daylight hours than at night.

We think the explanation is that most cosmic rays coming from the sun are detoured on their way toward the earth by the influence

of various magnetic fields which exist all through the solar system and the Milky Way as well.

Instead of traveling direct, the cosmic-ray particles are stirred up by these magnetic fields so that they travel in all directions and wander around in interstellar space for even as long as 10,000 years before reaching the earth. Such rays would come in just as frequently on the dark side of the earth as on the side toward the sun.

The most energetic cosmic rays, however, probably come from beyond the sun, from sources scattered throughout the vast reaches of the Milky Way.

Unceasingly bombarding every corner of the earth, cosmic rays provide a world-wide proving ground for studying some of the most fundamental laws of Nature. In pursuing their secrets, scientists have learned many lessons in earthly geography. Eventually cosmic rays may help teach us something of the geography of the universe.

Tropical Gardens of Key West

BY LUIS MARDEN

With Illustrations from Color Photographs by the Author

FROST-FREE is the word for Key West, one of the most southerly of the keys that curve down from the tip of Florida like the tapering tail of a sting ray. Rime's white fingers reach no farther south than Matecumbe Keys, some 70 miles to the north. Mild atmosphere makes Key West a tropic garden hospitable to cold-sensitive plants from the equatorial world.

Hibiscus, orchid, frangipani, passionflower, poinciana, and lignum vitae turn the island into a jungle of color. Sugar apple, custard apple, soursop, breadfruit, and sapodilla offer fruit flavors unknown to northern palates.

Each year the islanders, as if to congratulate themselves on escaping blizzards raging in the North, assemble their garden trophies in the Nation's southernmost flower show. The exhibition opens early in March in a hall on Rose Lane and lasts four days (pages 117-124).

Beauty Moves Indoors

For five days preceding the show, Rose Lane looks like the entrance to a beehive. A stream of trucks, cars, scooters, and bicycles delivers exhibits to the doors. The Navy sends loads of specimens and background plants; enlisted men bearing them swarm into the confusion.

Inside the air-conditioned hall, women in shorts, slacks, or bright dresses scurry about. One matron pushes a piano across the stage; another clears debris with a street sweeper's broom; a third sits exhausted in a wheelbarrow. Every Negro gardener in town seems to be working here.

On opening day northern visitors are entranced by exotic plants, many of them seen for the first time. Entire tree limbs display blossoms: the lignum vitae with its violet flowers so thick that a blossoming tree resembles a giant corsage of violets; the orchid tree, which looks as if some mad florist had stuck white or mauve cattleya orchids all over its branches; and spathodeas, which leap like tongues of flame from green foliage (page 120).

Palm trees so big that it takes six men to carry them stand in tubs. Graceful fronds six feet long droop from ferns.

Perhaps nothing in the show wins more popularity than the shadow boxes, those three-dimensional compositions of flowers and objects arranged to give a two-dimensional picture effect within a frame (page 119).

Other flower arrangements are at times so casual that once when someone placed three

scarlet hibiscus blossoms on a piece of driftwood as a souvenir intended to be taken home, the judges awarded a blue ribbon to the accidental display.

On the last day of the show all the school children come to see the flowers. Garden Club members find their greatest reward in the youngsters' shining eyes. One little girl stood open-mouthed just inside the door and whispered, "It looks just like a church."

All Flower Show exhibits come from family gardens, which range from a few plants in green-painted tin cans to big expanses of palm trees, orchids, flowering trees, and magenta masses of bougainvillea. Anglo-Saxon tradition places the flower bed in front of the house, but Key West, continuing Spanish custom, conceals the garden in back.

Medicinal herbs grow wild on vacant lots and roadsides. African Negroes coming to Key West via the Bahamas brought their vegetable pharmacopoeia with them.

For a fever "bush medicine" recommends that the patient sleep on a big green banana leaf. For earache it prescribes stuffing a small leaf of the castor bean into the ear. Sunstroke, it holds, can be warded off by a big castor-bean leaf placed under the hat. Believers in such remedies declare that another marvelous plant cures tuberculosis and also aids in birth control!

"Creatures" Police the Plants

To Key Westers all plants, however small, are "trees," and lizards dwelling in their gardens are "creatures." The little reptiles, welcomed by gardeners because they devour harmful insects, dart among flowers and plants of fantastic shape, size, and color. One chameleon attended the Flower Show (opposite).

Old-time Key Westers speak a brand of English marked by a Cockney flavor. Women in particular talk in a high singsong, their voices rising and falling in wavelets or scallops. To emphasize, they say something is "tall-tall" or "sweet-sweet." Moths that flutter through the twilight gardens are "bats."

Sea-minded islanders sprinkle conversation with nautical terms, as when they say that a storm "capsizes" a tree. "Grits and grunts"—hominy grits and the small but tasty fish called the grunt—combine in a favorite Keys dish.

Key Westers, who call themselves Conchs, love their little island. To the visitor they say, "You'll surely come back if you kiss a Conch and eat a grunt." I expect to go back.



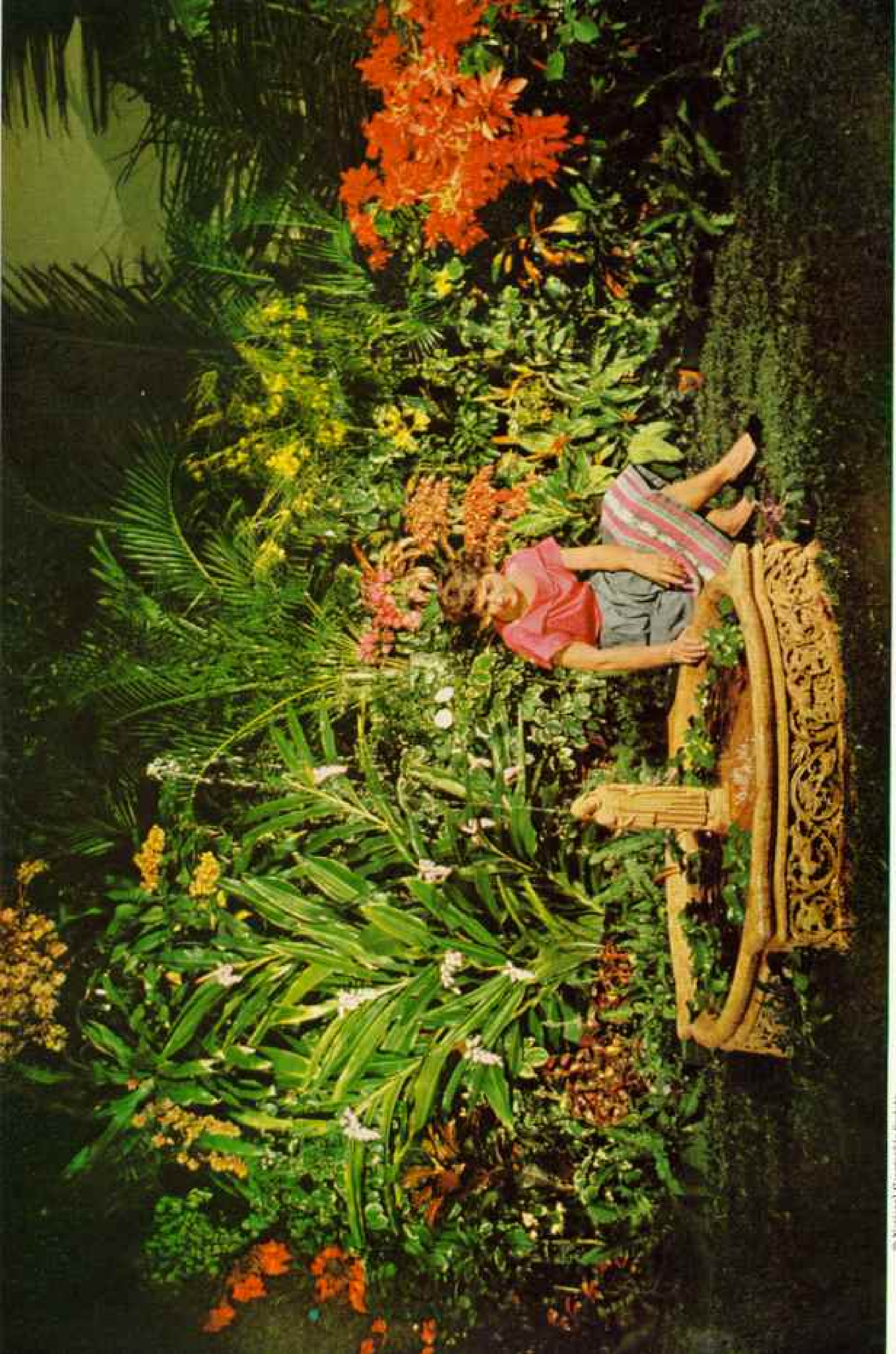
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Kodachrome for Luke Marden, National Geographic Staff

Key West Chameleon Rides an Air Plant at the United States' Southernmost Flower Show

Frost-free Key West grows a variety of tropical flowers; many of them seldom seen on the mainland because they do not stand shipment. Each March the island displays an abundance of blooms in its Flower Show. This vriesia, a relative of the pineapple and Spanish moss, was part of the Orchid and Exotic Exhibit, one of the most popular in the show. Contrary to general belief, the chameleon does not necessarily change hue to agree with the flower. He may run a gamut of shades from bright green to chestnut brown, depending on air temperature and his emotions.

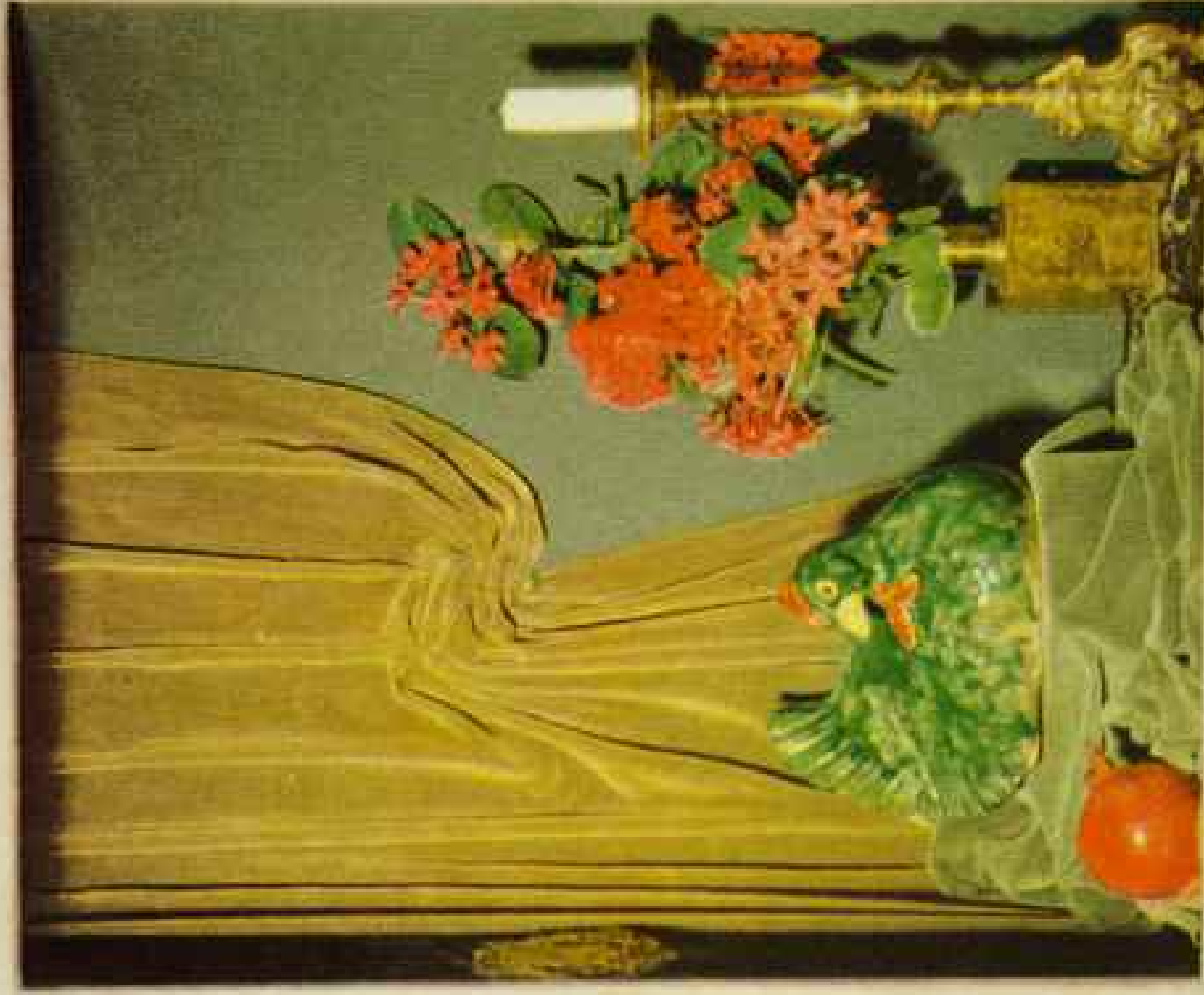


★ Massed Flowers Bloom for St. Fiacre, Patron of the Show. His Statue Stands in a Water Hyacinth Pool

Bible in one hand, spade in the other, this gardenier-monk, originally an Irish nobleman, gave his name to the Paris open carriage by way of the Hôtel St. Fiacre, which specialized in *fiacres* for hire. Background flowers include gliricidia, shell ginger, double datura, lily plant, Jerusalem thorn, and triple red poinsettia. Below: The shadow box, a picture in three dimensions, shows pomegranate and porcelain hen arranged with tropical red ixora. Right: Navy officers prepare a display in the vegetable-arrangement exhibit, open to men only. Candles emerge from artichoke holders.

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Kodachrome by Luke Martden, National Geographic Staff





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Subtle Datura: a Relative of the Poisonous Nightshade

Datura bush, attaining 15 feet, holds many foot-long trumpetlike flowers whose fragrance sends the night air.



Few Americans Ever See Spathodea, the African Tulip Tree

These tropical blossoms do not tolerate shipment, for cut flowers die in a day. The tree blooms riotously twice a year.

Flowers of the Odorless Hibiscus, One of the Show's Most Exciting Displays, Shine in the Dark Glasses of a Spectator

Hundreds of unopened buds, cut daily during the show, are refrigerated overnight. In the morning each bud is painstakingly mounted on the midrib of a coconut-frond leaflet. Within an hour the warm air brings out the full bloom, which lasts but a day.

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Illustrations by Julia Marden, National Geographic Staff



Climbing Pothos Grows Huge Leaves in Outdoor Settings

This vine from the far-off Solomon Islands enjoys its adopted home in south Florida. Here it grows luxuriantly in full sun or shade, in dry soil or moist. A piece of vine placed in a water vase lives for months.

Growing in profusion all over Key West, the climber sometimes becomes a nuisance. Its stems and leaves clasp palms and other trees in such thick embrace that their very weight often breaks the support. Gardeners continually trim away the excess.

Raised indoors, the plant sometimes produces only small leaves. Growing under suitable open-air conditions, the leaves may attain a length of two feet.

When the leaf becomes large and saillike, air slots open in its sides, allowing winds to pass through without blowing the leaf off the vine.

Botanists used to call the plant *Pothos aureus*. Lately they have settled on the name *Scindapsus aureus*.

© National Geographic Society



Tree Frogs Doze on a Cool Banana Plant . . . Orange-red Blossoms of the Shrimp Plant Resemble Boiled Shrimp

An industrious insect chaser, *Hyla septentrionalis* makes his home only in the West Indies and Key West. He is thought to have entered Florida as a stowaway on a storm-blown creelict. He sleeps by day, hunts by night, sings before a rain. First-size females are twice as large as the males. The shrimp plant blossom's resemblance to the crustacean is heightened if the picture is heightened upside down.

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Illustrations by Lute Marden, National Geographic Staff





Passionflower in Hair: Dramatic and Alluring

Shadow boxes (page 119) featuring passionflowers create a sensation among Key West visitors. Out-of-town judges have awarded them many a prize.

The blossom takes its name from a fancied resemblance to the instruments of the Crucifixion, the corona representing the crown of thorns and the three styles the nails of the cross. Five petals and five sepals stand for ten of the apostles. Tendrils of the vines suggest scourges, and leaves the hands of the persecutors.

✧ Bombax's blossom has the size and satiny texture of a magnolia flower, but its petals are a rich cardinal red and the stamens yellow. The tree bears few leaves when in full bloom, so that it appears a solid mass of scarlet. Fallen petals color the ground for weeks.

Bees and other insects love the bombax, so rich is its yield of nectar. A Key West woman told the photographer: "Every morning I go into my garden and fill a glass with nectar just by tilting four or five bombax blooms."

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Kodachromes by Lutz Harden,
National Geographic Staff

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First Photographs of Planets and Moon 125 Taken with Palomar's 200-inch Telescope

BY MILTON L. HUMASON

Staff Astronomer of the Mount Wilson and Palomar Observatories

PRESENTED exclusively in this issue of the NATIONAL GEOGRAPHIC MAGAZINE are some of the first photographs of the planets and moon made with the world's largest telescope, the 200-inch Hale reflector on Palomar Mountain, California.

These photographs do not represent the best the Palomar instrument is capable of making. With better atmospheric conditions it will be possible someday to secure even clearer and sharper pictures. However, it may be some time before better ones can be made, because ideal conditions for such photography are extremely rare.

For this reason and because of great popular interest in what the big camera might reveal on these comparatively near-by heavenly bodies, the pictures are presented now. They are typical of the planetary and lunar photographs made with the 200-inch telescope during the past two years.

Details Shown on Larger Scale

Although the new photographs may not reveal much new detail, they do show known details on a larger scale than ever before.

The planets Venus, Mars, Jupiter, and Saturn are included in this series of photographs. Pictorially these four are more interesting than Uranus, Neptune, and Pluto, which are so far away that even in large telescopes they show little detail. Pluto, the most distant planet, 3,670 million miles from the sun, is only a pinpoint of light even on 200-inch telescope photographs. Uranus and Neptune show as small disks.

Mercury, the planet nearest the sun (only 36 million miles from it), would be interesting to photograph if it could be reached with large telescopes. However, because Mercury is so close to the sun it is rarely seen, and then only for a few days at a time at twilight or in the dawn-lit sky, and always low down on the horizon.

Venus, Mars, Jupiter, and Saturn are of special interest for several reasons—Venus, because it is most nearly like the earth in size and is also somewhat similar in brightness, density, and possibly in climatic conditions; Mars, because of the interesting surface detail which can be seen and photographed; Jupiter, because it is the largest planet and exhibits strange and changing details in its atmosphere; and Saturn, because it is the only known planet encircled by a system of rings.

To the naked eye, Venus is the most beautiful of all the planets (page 129). Periodically it appears as both the morning and evening star, so brilliant that it can be seen in daylight with the naked eye. Several reports of flying saucers have been traced to such appearances of Venus.

The kind of animal or vegetable life that we know on earth probably could not exist on Venus. Observations with a spectroscope show carbon dioxide in its atmosphere, but little or no free oxygen and almost no water. Seen through a telescope, Venus always appears to be covered with clouds, so that only indistinct dark areas can be observed in its atmosphere.

Probably the most controversial of all the planets is Mars. In 1877 the Italian astronomer Giovanni Virginio Schiaparelli announced his discovery of faint lines on Mars which he called *canali*. This Italian word can mean either "canals" or "channels." Some people have assumed that he meant canals, but recent evidence indicates Mars probably could not support higher forms of life.

Not All Observers See Mars' "Canals"

Since then, other competent visual observers have seen and mapped these features with telescopes as small as six inches in diameter, but some astronomers, equally competent, have failed to observe them. If the network of narrow, dark, straight markings could be photographed, however, they would form a permanent record, and there would no longer be doubt of their existence. A few of the wider features classed as canals have been recorded on photographs made at other observatories. Two appear on the Palomar photograph (page 127), but not the network of fine lines seen by the visual observers.

Probably it will always be true that the eye can see more through the proper type of telescope than can be photographed, but astronomers will always hope that in time improved techniques, combined with almost perfect atmospheric conditions, will make it possible to photograph the "canal" system of Mars, if it really exists.

Other features of interest shown on this planet are the polar caps, which vary in size with the seasons, and permanent markings which show a seasonal variation in color.

Jupiter, largest of the planets, is one of the most interesting to photograph because of the

great amount of changing detail that it exhibits (page 129). Its markings consist of belts running parallel to its equator, with additional detail in and between the belts. None of the markings are permanent. Some last for a few days or weeks; others, like the Great Red Spot, continue to appear, but change in form and position.

This means that all the markings on Jupiter are atmospheric in character and that no firm surface is ever visible. Photographs of the spectrum of light reflected from Jupiter show a considerable amount of methane and ammonia present in the atmosphere. It would be difficult to believe that any type of life could develop there.

Saturn, next largest of the planets, is a beautiful sight when seen through a moderate-sized telescope or on a photograph (page 128). Galileo, the pioneer Italian astronomer, first noticed its unusual appearance in 1610. In his small telescope it appeared to have appendages on each side. Some 45 years later the Dutch astronomer, Christiaan Huygens, with a better telescope, discovered that the appendages were parts of a ring encircling the planet.

As telescopes improved, it was found that actually there were three rings, each clearly separated from the others. In the Palomar photograph the rings are too nearly edge on to show the separation clearly, although the division between outer and middle rings is noticeable at the two ends.

The break in the ring system next to the ball of the planet at the upper left is the shadow of the ball on the rings. Where the rings pass in front of the planet they cast a narrow shadow on the ball.

Moon's Largest Crater

The photograph of a portion of the moon's surface (page 130) shows the large walled plain or crater, Clavius, the largest on our satellite. It is the first good lunar photograph made with the 200-inch telescope.

On the wall which surrounds Clavius appears the recently named crater, Porter, which honors the late Russell W. Porter, explorer and astronomer, who was beloved alike by amateur astronomers and his colleagues at the Mount Wilson and Palomar Observatories.

His beautiful detail drawings of the Palomar telescopes were immeasurably valuable in visualizing those instruments while they were still in the planning stage. Porter was keenly interested in the moon's surface details, and while he sat at the eyepiece of the 60-inch telescope on Mount Wilson, he made some superb lunar drawings.

At the time Clavius and Porter were photographed, only a 4-by-5-inch plateholder was

available. The scale of the photographs, as reproduced, is therefore about twice the scale on the original negative.

Whether a telescope is large or small, the problem of obtaining good planetary and lunar photographs is one of the most difficult in astronomy.

One of the very important factors involved is "seeing," a term used by astronomers to estimate the steadiness, size, and sharpness of the image of a heavenly body.

"Seeing" does not refer to cloudiness. In fact, it is on clear, windy winter nights, when the stars twinkle, that poorest seeing occurs. Excessive twinkling causes bad definition at the telescope and produces pictures which are fuzzy and ill-defined.

Good seeing occurs more frequently in late spring, in the summer, and early fall. Excellent seeing conditions, such as those needed for planetary and lunar photography, may occur only a few nights in a year.

Earth's Atmosphere a Handicap

Poor seeing is caused by the mixing of hot and cold air in the earth's atmosphere. If telescopes could be situated outside the earth's atmosphere, seeing would be perfect at all times. An ideal site would be the moon, which has no atmosphere, or the kind of space platform which some people believe will eventually be built as an artificial satellite of the earth.

Although the large scale of the 200-inch telescope is advantageous for separation of detail, excellent photographs of the planets and of the moon can be obtained with smaller telescopes.

Probably the finest existing collection of photographs and data on the planets, especially Mars, has been built up with the 42-inch reflecting telescope at Lowell Observatory, Flagstaff, Arizona. There Dr. Percival Lowell (now deceased), Dr. V. M. Slipher, the present director, and his brother, E. C. Slipher, have gained wide recognition as authorities on planetary photography. Dr. W. H. Wright and other astronomers at Lick Observatory, Mount Hamilton, California, have made excellent photographs of the moon and planets with their 36-inch refractor and 36-inch reflecting telescope.

The problem of reproducing our photographs without losing the dim, elusive features that appear on the original negatives is as difficult and important as the observations at the telescope. I should therefore like to take this opportunity of thanking the NATIONAL GEOGRAPHIC MAGAZINE and William Miller, our staff photographer, for their understanding of this problem and for the resultant excellent quality of the reproductions.



Palomar's 200-inch Camera Pictures Mars' Atmosphere (Above) and Its Surface (Below)

Built to peer one billion light-years into space, the Hale telescope has now turned to earth's neighbors, the planets. First results, here published in the NATIONAL GEOGRAPHIC MAGAZINE, reveal no new discoveries but clarify details. Not even the giant eye, however, is able to distinguish the Martian network of lines, some of them 1,500 miles long, which astronomers can see but cannot yet photograph. One observer convinced himself that the lines were canals dug by intelligent beings to carry irrigation waters from icecaps to parched central regions.

Blue light, which cannot penetrate atmosphere, was used in taking the view above. White areas at the poles appear to be fog above thin layers of snow. Penetrative red light exposed the scene below. Large dark areas may show vegetation, for they vary in color with the Martian seasons, appearing blue-green in spring, browner in fall.





Saturn's Gigantic Halo: Tiny Particles, Each Moving in Its Own Particular Orbit, Form the Ring System

Twice during Saturn's 10-year revolution around the sun, the three main concentric rings present a knife-blade edge to the earth. Here they tilt just enough to reveal their circular shape but not their triple nature. Two black blobs at either end represent all that may be seen of one circular separation band. Composed possibly of material which never formed a satellite, the rings are 171,000 miles in diameter but only 10 miles thick. Though semitransparent, they are solid enough to cast a shadow on Saturn. The shadow of Saturn's globe here blots the rings at the left.

← A Great Red Spot Floats on Jupiter's Banded Sphere

Broad belts of alternate light and dark, like exaggerated lines of latitude on a map, mark Jupiter's globe. Markings change their shapes and positions, indicating they are clouds floating above a surface never seen from earth.

Similar movement has taken place in the Great Red Spot (upper left) since its detection in 1878. Thirty thousand miles long, this baffling patch lies in the southern hemisphere, inasmuch as the planet is here inverted by the telescope's optical system. At times the spot's color fades into virtual invisibility.

Largest of the sun's attendants, Jupiter has a mass 320 times that of the earth. Conveying a dozen moons, it swings around the sun in 12 of our years, but its day lasts less than 10 hours. Its speed of rotation, a dizzy 27,000 miles an hour at the equator, results in a noticeable flattening at the poles, where centrifugal force is less.

Venus Has Phases → Like the Moon's

Earth's closest neighbor perpetually veils her face beneath a sea of clouds. At intervals of about a year and a half, when she draws nearest to us, Venus becomes the evening star, which is bright enough to cast a shadow. Because her orbit lies between sun and earth, the planet reflects varying segments of light as she exposes sunny side or dark. This view shows Venus illuminated by the sun almost directly ahead.

Mount Wilson and Palomar Observatories



Face to Face with the Moon! The Big Eye Shows Our Satellite as if 200 Miles Away

Moon's lack of atmosphere invites no parachute jumps, but it encourages clear, sharp photographs. Close-ups reveal a harsh desert ribbed with mountains, some approaching the height of Everest. Unexposed to erosive wind and rain, the surface features stand eternally changeless. Weird craters appear to have been gouged by meteors.

Shining into the craters from the right, the sun here paints crescents of light and leaves pools of shadow. Largest abyss is 150-mile-wide Clavius (center), whose walls rise 12,000 feet. The lower of two fair-sized pits on Clavius's left rim is named for Russell W. Porter, who helped design the Hale telescope. Smallest pits in the floor of Clavius are two to three miles in diameter.

From Spear to Hoe on Groote Eylandt 131

At a Lonely Outpost of Stone Age Arnhem Land, Once-nomadic Australian Aborigines Settle Down to Farm Life

BY HOWELL WALKER

With Illustrations from Photographs by the Author

THIRTY-FIVE men of Arnhem Land shouldered their hoes and walked away from the fields that fed them. Only a tropic sun, close to the horizon, signaled time to go. The blackfellows left the evening stillness and smell of wet earth to their white leader and to me.

Around this garden a native settlement grew up under the care of Fred Gray. Community and crops sprang from seeds he planted at Umbakumba in northern Groote Eylandt.*

Over the island, largest in Australia's vast Gulf of Carpentaria, aborigines had roamed throughout countless centuries. With spears and throwing sticks they hunted food and fought for things men still fight for. They lived from day to day, hand to mouth, from one campfire to the next.

When Gray, the only white man living permanently on Groote, first moved there 15 years ago, some natives went to work for him; then others showed up; even more, later. And they stayed. These nomads found they could really settle down (page 132).

Out of the Stone Age

Clearing ground, hoeing or planting, irrigating or harvesting, aboriginal men learned to think beyond the present moment; learned to live and plan for tomorrow, not just today.

They emerged from Arnhem Land's current Stone Age to uncover new fields, pushing back their primitive ways with the primeval bush. They cultivated themselves as well as the 12-acre garden.

"This land, like much of the island, was all sand," Fred said, leading the way through fresh, moist furrows. "But we enriched it with stuff from the bottom of an emptied billabong."

(A billabong is a natural reservoir supplied by rain.)

"Whole secret of the garden is water," he continued. "See the wetfulness of it even now in the dry season. If we didn't irrigate, the soil would become drier than tinder . . . No, thanks, I never smoke, but you go ahead; nothing here would burn."

*See, in the NATIONAL GEOGRAPHIC MAGAZINE: "Exploring Stone Age Arnhem Land," by Charles P. Mountford, December, 1949, and "Cruise to Stone Age Arnhem Land," by Howell Walker, September, 1949.

Three billabongs held rains of the wet season for irrigation during the dry. The system depended upon gravity; and it failed when water levels dropped below that of the garden.

"So we installed a pump engine," Fred explained, "and now grow vegetables all year round."

He pointed out long rows of sweet potatoes, cassava, yams, pumpkins, and melons. We looked at lettuce, carrots, onions, turnips; walked past beans, beets, squash, and cabbage; paused in the damp coolness of banana leaves and pawpaw trees. For the first time I saw pineapple in flower.

On the way back to Gray's homestead we overtook a flock of goats. Two aboriginal women brought up the rear; each toted a load of firewood on her head, a baby astride one hip. Small boys at the front steered the herd toward a corral for evening milking.

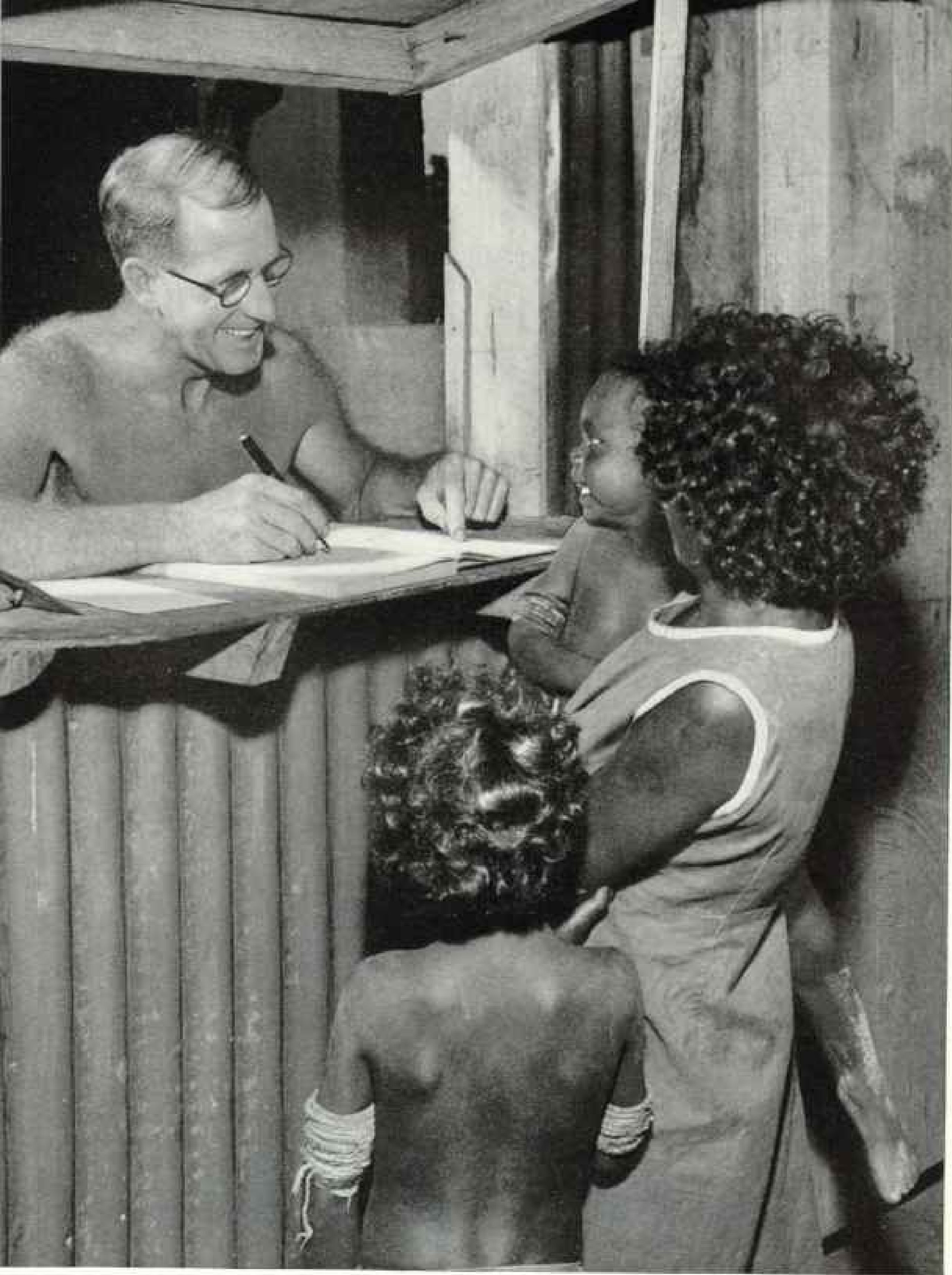
The rambling homestead had a paperbark roof lower than neighboring sand hills. From the house a wide beach sloped gently to Little Lagoon, a well-sheltered bay on Groote's north coast. In the quiet water a slender black stood still as a stake, his spear poised to pierce a fish.

Nanjuripia, head houseboy, waited on table at supper (page 136). After we finished, he had his meal in the kitchen. Then Fred called Nakaramba, No. 2 boy, to clear away the dishes.

"When you've done that," he added, "you may take some ice cream from the refrigerator."

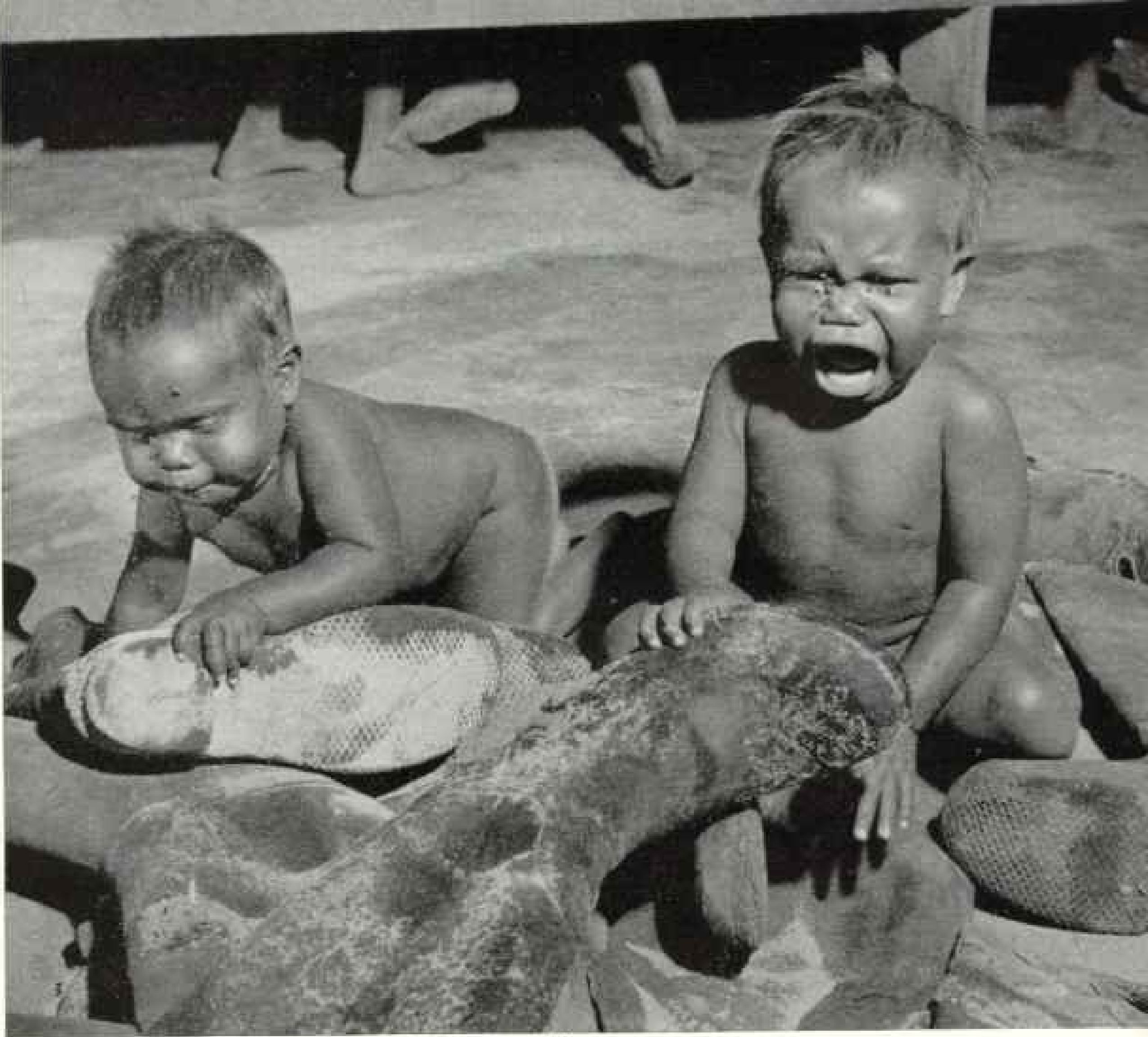
Before he settled at Groote Eylandt, Fred





Roll Call Brings Mothers and Children to Fred Gray's Office Window on Groote Eylandt

Aboriginal Australians, contrary to their nomadic nature, have settled down to farming on this lonely island in the Gulf of Carpentaria (map, page 131). Mr. Gray, a native of England who tried fishing and pearling before he established the settlement, supervises some 150 natives farming a 12-acre garden. Once a week he checks their names against the register for a report to the Government. Births and deaths are recorded at his window.



A Jumble of Outsize Boots Intrigues Sister, Baffles Brother

No aborigine on this island of bare feet seriously uses boots, but boys occasionally wear them in jest (page 139). Superintendent Gray, who salvaged these rubbers from a wartime RAF base, finds little use for them. Bahies belong to a mother attending school (her feet appear under the bench).

Gray sailed along the shores of Arnhem Land. He fished for trepang (*bêche-de-mer*). During stops at coastal camps the white man made many friends among the aborigines.

Again and again his boat worked Little Lagoon, gathering substantial loads of trepang; and each time he sailed away, Gray looked longingly toward Umbakumba, its paperbark trees, the golden wattle, and the future.

Dreaming of a New Home

He began to dream of home—not the one he had left in England, but the home he hoped to make at Umbakumba, Groote Eylandt.

Then in the late 1930's Gray dropped anchor in Little Lagoon with a finality that exuberantly shouted, "This is it! This is where I'm going to live."

Island folk, met on previous visits, helped

him build a bark house on the spot he had long ago selected. Other natives arrived to welcome the white man of Arnhem Land and offered their services. Almost overnight a sizable blackfellows' camp appeared beside his own.

Although Gray was a good sailor, his heart belonged to the soil. He had tried wheat farming in Western Australia on arrival from England in 1923. A severe drought defeated him, ruining the acres he had paid for, cleared, plowed, and planted.

"Just had to walk off my land," he told me; "no formalities, no money, not much hope. As our aboriginal friends would say, 'Yes, nutting.' That means 'No, absolutely nothing.'"

So Gray once again turned to the earth. Even if sand did cover most of Groote Eylandt, he would have a garden. The natives

pitched in, cutting brush, hoeing rows, making water catchments.

To the aborigines, at first, so much work for food seemed unnecessary, even silly. They had always been able to find enough to eat simply by walking through the bush, along the shores, or in the lagoons; and spears were lighter than shovels and such.

Plan Begins to Make Sense

In the end, however, the fruits of their labor in the fields amounted to more than something to eat; the blackfellows began to see sense in this white man's ways.

And the Groote Eylandt native settlement began to support itself. Gray had laid the foundation of the only cooperative organization of its kind in Arnhem Land or all of northern Australia. Blackfellow and white shared the harvest as well as the work.

Timid wives and wide-eyed children moved in from the bush to live with the men. Their low bark shelters like stunted Quonset huts dotted the dunes.

The homestead expanded with the need of storage space for tools, seeds, produce, and supplies. Addition of a kitchen and bedroom made the house more livable in torrential wet seasons.

It rained so hard one year that Gray took a number of the children under his roof. This led to a dormitory arrangement with boys up to 15 years old in one long room; girls, until they married, in another.

When sloppy weather messed up garden routine, the white man turned schoolmaster. He taught the three R's; and his pupils quickly caught on to tunes and words of English songs he sang.

The Feminine Touch

Marjorie came out from England in 1946 to marry Fred; they'd been engaged for 20-odd years. She took over school and domestic responsibilities (page 138) and showed native women how to sew. While her husband continued to improve the vegetable garden, she planted flowers around the homestead.

Now the settlement followed a pretty regular routine. I slipped into it during my visit to Groote Eylandt, but only as an observer.

Mist among the sand hills melted away with the first rays of the sun. Through the front yard boys dragged hoses to water flowers and shrubs. Other lads, swinging pails, went to the goat pen for milking. Girls followed their long shadows over the beach, gathering shellfish. Thin blue smoke rose straight up from fires in the native camp.

Someone banged an iron bar hanging to a tree behind the homestead, and everyone

turned to morning tasks: men in the fields; women somewhere along the shore, looking for crabs; boys and girls fetching soil to enrich flower plots; Marjorie at the weather box, recording temperature, humidity, wind, and cloud for monthly reports that reach Melbourne only by infrequent and irregular mail service. Without the statistics a big gap would occur in the Commonwealth's weather records.

A dugout canoe scraped sandy bottom in the shallows of Little Lagoon. Two lean young bucks, shiny black against the blue bay, leaped lightly into the water and shoved their craft toward the beach. Although lugging heavy buckets, they walked easily, even gracefully, up to the settlement.

The two aborigines delivered goat milk to Marjorie. She gave them tobacco, which they promptly prepared to smoke in the shade of a large paperbark. All arms and legs, they relaxed completely, as this dark race so inimitably can.

Every evening these "dairymen" crossed to the opposite shore where a herd of goats (in addition to the flock at Umbakumba) grazed. There they milked some 50 nannies, spent the night, milked again early next morning, then returned. It made tiring work, especially when they had to paddle against strong tides running in the not-so-Little Lagoon.

All Parts of Turtle Used

Occasionally the goat men brought back a huge turtle for a feast. Inedible parts, including the broken-up shell, went to the garden as fertilizer.

School began about 10 a.m. after Marjorie had completed meteorological and domestic chores. Students filled the long classroom and soon settled down to the usual elementary lessons. Besides the children I expected to find there, I saw several mothers with unweaned babies.

No one could attend school unless properly dressed, washed, and combed. Mirrors didn't exist in the dormitories; so children parted one another's hair. Sometimes they used reflections in a drum of oil to order their locks.

A number of unclad children on the classroom benches broke the uniformity of girls' white dresses or boys' maroon *nagas* (loincloths); at the settlement a child normally goes naked until aged six or seven.

Shortly after noon, 35 working men and 40 children sat down to plate dinners in another large room adjoining the school (page 139). Mothers with nursing infants received rations from the storehouse and prepared meals in camp for themselves and their offspring.

It seemed to me somewhat hard on these



A Flour Sack Clothes a Farmer Planting Cassava in Irrigated Fields

Bitter cassava provides the tapioca made by food processors. Groote Islanders grow a sweet variety, which they cook entire and eat as they would a sweet potato. Water turned this dry, sandy land into a productive farm. The planter inserts year-old cuttings, which will develop swollen edible roots.

women, who had to line up outside for flour, sugar, and tea to supplement their native diet. Through an open door they could see husbands, sons, and daughters at table with heaping plates of beef and onions, wheat meal porridge, sweet potatoes, pumpkin, and cabbage. Yet not a woman looked underfed.

Menial Jobs for Women

According to ageless laws of aboriginal society, women took a back seat. To them were delegated the menial, but nevertheless important, responsibilities. They gathered firewood; dug wild yams in jungle scrub; pulled edible lily roots in marshy billabongs; collected crabs and oysters on rocky shores; and looked after children until the tots were old enough to feed themselves.

The men were the "big shots"; they made laws and carried spears. Wherever or when-

ever they camped, it behooved the whole family so to do. Men hunted, grunted, fought, and thought; hacked heavy canoes out of big trees; harpooned turtles and dugongs; speared fish; sang and danced; painted ceremonial objects in colorful patterns, or sketched tribal omens on cave walls.

In short, men brought in the meat, drove out the enemy, and had most of the fun. Women could be . . . well, just useful.

A woman had no choice in marriage matters. While still an infant, the first daughter of a family was promised to her mother's brother, whose wife she became, like it or not. Without any ceremony, he simply claimed her when marriageable. And, as her husband, he could automatically claim any sisters she might have.

In this old order of aboriginal life Fred Gray had some say at the native settlement.



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★ Nanjuripia, the Grays' Houseboy,
Serves Dinner at the Homestead.

Scars, which the waiter considers manly decorations, were made by rubbing ashes into incisions. The kerosene refrigerator was installed during the author's visit. Its flame-into-ice puzzled houseboys as much as its ice-cream making delighted them.

✧ Quart Pot, the Father, Gathers
His Family Around the Campfire

Out on a fishing trip, these people slept beside a windbreak. The toy dugout amused the children for hours at a time. Spent flash bulbs fascinated them briefly. Quart Pot was named by a white man who found his true name, Nangapianga, hard to pronounce.



He tried new ideas, drew up his own regulations, and aimed at a fair deal for all.

But native customs, strong enough to endure untold centuries, didn't die overnight, or even within a decade in some instances. Umbakumba women continued to take a back seat.

Upon one thing Gray rigidly insisted, and in it he singularly succeeded: one wife per man. Polygamists had to clear out.

Although it might appear that men generally had more privileges than women, they got only what they earned at Umbakumba. A man worked hard; if not, no food or tobacco. He had his choice: either back to the garden or back to the bush. The settlement asked less of a woman.

So earnest laborers ate well and rested after dinner. Then glistening black backs bent again in the fields. Small dark heads leaned over lined papers, birdlike hands busily scratching away at the alphabet.

School Out, Children Play

An awkward flight of white cockatoos squawked rancously in the quiet of later afternoon. Marjorie dismissed the class. Some boys rushed to the beach to play soccer, others to the lagoon with toy sailboats. Sitting in a circle on the sand, girls turned sticks or stones into dolls dressed in scraps of bright calico.

Toward sundown I walked in from the garden with Fred. We followed a fellow carrying a boomerang.

"But Groote Eylandt natives don't use boomerangs, do they?" I asked.

"Only to fight with," Fred said. "There are rumors that a mainland tribe plans to attack Umbakumba, and some of our boys are merely getting ready."

"What would they be fighting about?" I asked.

"The mainlanders believe that one of the women here in the settlement really belongs to them," Fred told me, "and they're coming over to get her. The Umbakumba natives won't let her go without a fight. It's the same old story—squabbling over a woman."

Because of the possible attack on Groote Eylandt, Fred let the men put their spears in fighting trim. They prepared shovel-nose and wood-barbed types. The former was made by arduously pounding a steel rod into a flat blade about a foot long. Slightly rounded at one end and sharpened at the edges, this head fitted into a slender wooden shaft. White man's steel had replaced quartzite of the Stone Age.

The other type consisted of a dozen barbs carved along the business end of a wooden spear somewhat longer than the shovel-nose kind. Savagely inextricable, it dated from who knows when.

When finished with their weapons, the natives had to turn them over to Fred. They could reclaim them only in the event of tribal war. If allowed to keep these spears in camp, men sometimes used them to win a point in disagreements among themselves.

Gray's ruling did not apply to lighter javelins used for stabbing fish.

False Alarm; Weapons Returned

Once, in Fred's absence, the defenders of Umbakumba had gone to Marjorie for their fighting spears. They had seen fires to the northwest and believed the enemy assembled there. It all pointed to an attack on the settlement. So Marjorie handed over the weapons.

"And be sure to bring them back as soon as you've finished," she said, as if lending children scissors to cut out paper dolls.

Shortly afterward, the blackfellows solemnly returned the borrowed goods. Another false alarm. They withdrew to the garden and began to hoe sweet potatoes.

I stopped by the goat pen to watch boys at evening milking. A restless nanny kicked over a partly filled pail.

"Ah, naughty girl," scolded a boy. "Wasting milk!"

All too often while watering flowers by the homestead, he himself had heard the reprimand, "Ah, naughty boy, wasting water!" But now he could exercise his authority over an unruly goat, and he didn't miss the opportunity.

After supper, children gathered regularly in the Grays' dining room for the customary handout of candy—two lollies per child. One day Marjorie told the whole class there would be no candy that evening; all had behaved badly in school.

Nevertheless, they showed up as usual after supper.

"What did I say to you at the end of class today?" Marjorie remonstrated.

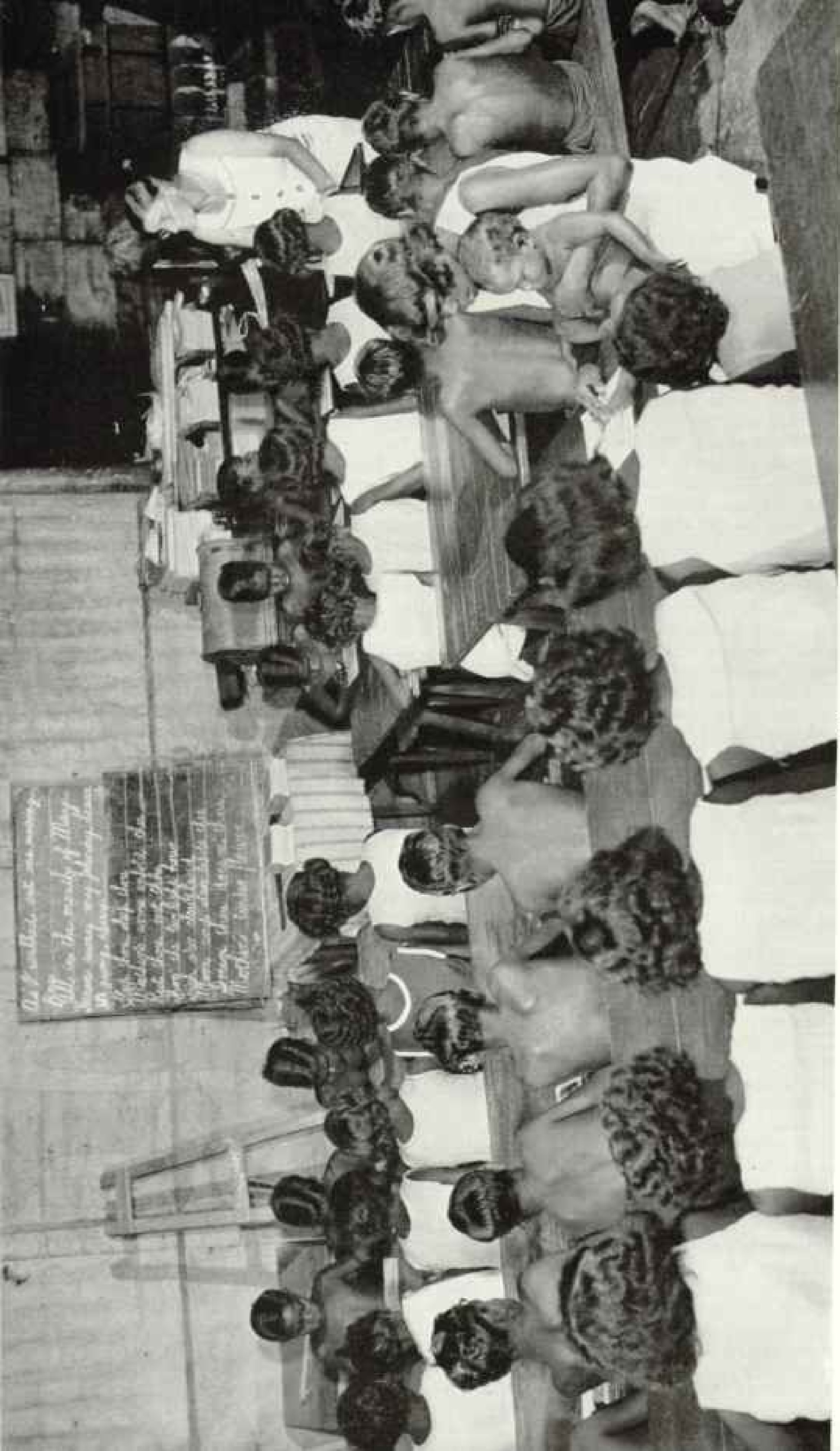
"You said, 'Good afternoon, children,'" volunteered one of the smaller boys with a very innocent expression.

Who, in her place, could have withheld the lollies?

A Session with Magazines

Later, some boys asked permission to look at magazines. In groups of three or more they huddled on the floor, earnestly discussing each picture. They particularly liked color photographs in the NATIONAL GEOGRAPHIC.

The fully lived day at the settlement ended only when native singing and dancing died in the deepening night. Then I listened to Little Lagoon whispering to an empty beach. And I heard an owl outside my window contradict the quiet.



Girls in Dresses and Boys in Loincloths Attend a School Taught by Mrs. Gray, Only White Woman in the Community.

The superintendent's wife supplements the three R's with songs written out on the blackboard. Often at night the children gather around campfires and hold their own concerts. Breckes carry away such airs as "My Old Kentucky Home" and "Oh, Dear, What Can the Matter Be?" Young natives learn English rapidly.

Japonia Waters the Superintendent's Orchids →
 Every boy and girl at the settlement has daily chores to perform. Japonia takes care of the orchids, which grow in hollow logs. He wears boots just for fun.

✓ Farmers and children are fed a community meal. These dishes will brim over with beef, peas, sweet potato, cassava, and pumpkin.

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From midday Saturday until Monday morning, natives of the settlement may do as they choose; work in the garden ceases during that period.

Some go "walkabout" as a whole family, hunting in the bush, spearing fish, gathering crabs and oysters. Some find local jobs: repair humpies (low huts), make spears, whittle pipes of bloodwood, play with children, and so on. Others just sleep or loll around the camp.

Sunday reveals one difference between Groote Eylandt native settlement and any mission station in northern Australia: no church services. However, children receive religious teaching during the week. School opens with prayers followed by Bible stories; pupils have learned 80 hymns. A Christian mission on the island holds Sabbath services.

Vegetation of Many Hues

One Saturday I joined a group of men and boys taking a week-end walkabout to Groote's east coast. Our journey covered but a fraction of the island, which is about 40 miles long and almost as wide.

Wattle in full blossom splashed olive-gray scrub with masses of brilliant yellow. Honey eaters flitted between red and orange *Grevillea*. On a bush the natives called *miruoa* bloomed two-inch bells the color of sun-tanned rosy cheeks. Drifts of strawflowers resembling pink clover rose knee-high in generous sprays. So small that I had to bend over to see it, something with delicate lavender petals grew flush with the sand.

The sand, tons of it . . . everywhere . . . sand, sand, loose white sand. It turned the trail into a treadmill. I moved ineffectually as if in a nightmare or walking in water over my head. Unlike me in GI boots, barefoot natives fairly glided along without apparent effort. Even little boys nipped briskly past me, looking back to ask, "You tired?" My wet drawn face and laborious plodding answered the foolish question.

I dropped farther behind as the others hurried to reach our destination before dark.

Tentless, we camped under a cloudless sky beside tea-colored Amarepa Creek. Fifty yards away a heavy surf roared at the sandy coast. A scrubby hummock afforded some shelter from the strong southeasterly wind.

With us we had a limited amount of flour and a bit of tea—nothing else in the food line. But several men were soon trying to spear our fish course. Others started a fire, put on the billy (bushman's teapot, really a pail), and mixed flour and water to make damper—unleavened, unsalted bread baked in ashes, but not long enough.

The fishermen returned with nothing but

their spears, discouraged by wrong tide and too much wind and surf. So we dined on plain tea and blackfellow's damper.

After eating, the natives made half a dozen fires at 6-foot intervals; these were the "blankets" for 12 persons, naked except for loincloths. I alone had a bedroll.

At daybreak my unclothed companions roused themselves and the fires; the night had been cold and damp. They brushed sand from their eyes and off the backs of each other. Lying in dew-drenched blankets, I watched the sun rise. Breakfast duplicated exactly the meal of the previous evening.

Southward along the shore I went with men determined to spear fish.

About a mile from our camp the white beach gave way to rough dark stone. A little farther, and the rugged shore turned salmon pink, marvelous to see against clean blue sky.

Clever as crabs, the fishermen skittered over surf-splitting rocks. I struggled clumsily behind. With the keen eyes of hungry gulls they scanned shallow coves for targets, but could score no more than two parrotfish.

When convinced of wasting time, we saw one of the boys approaching. He told us that the others had found a large live turtle and lots of eggs a mile or so north of camp. Anticipation of a good feed carried the men away up the beach in a body.

I'd had so much sand slogging that I stopped at Amarepa Creek. Hot from the struggle of just walking, I stripped and plunged into the fresh water. How completely satisfying to drink through every pore when thirsty all over!

Speak Up or Go Hungry

At last the turtle arrived—in pieces. The natives had cooked it where they found it; a few had already eaten some.

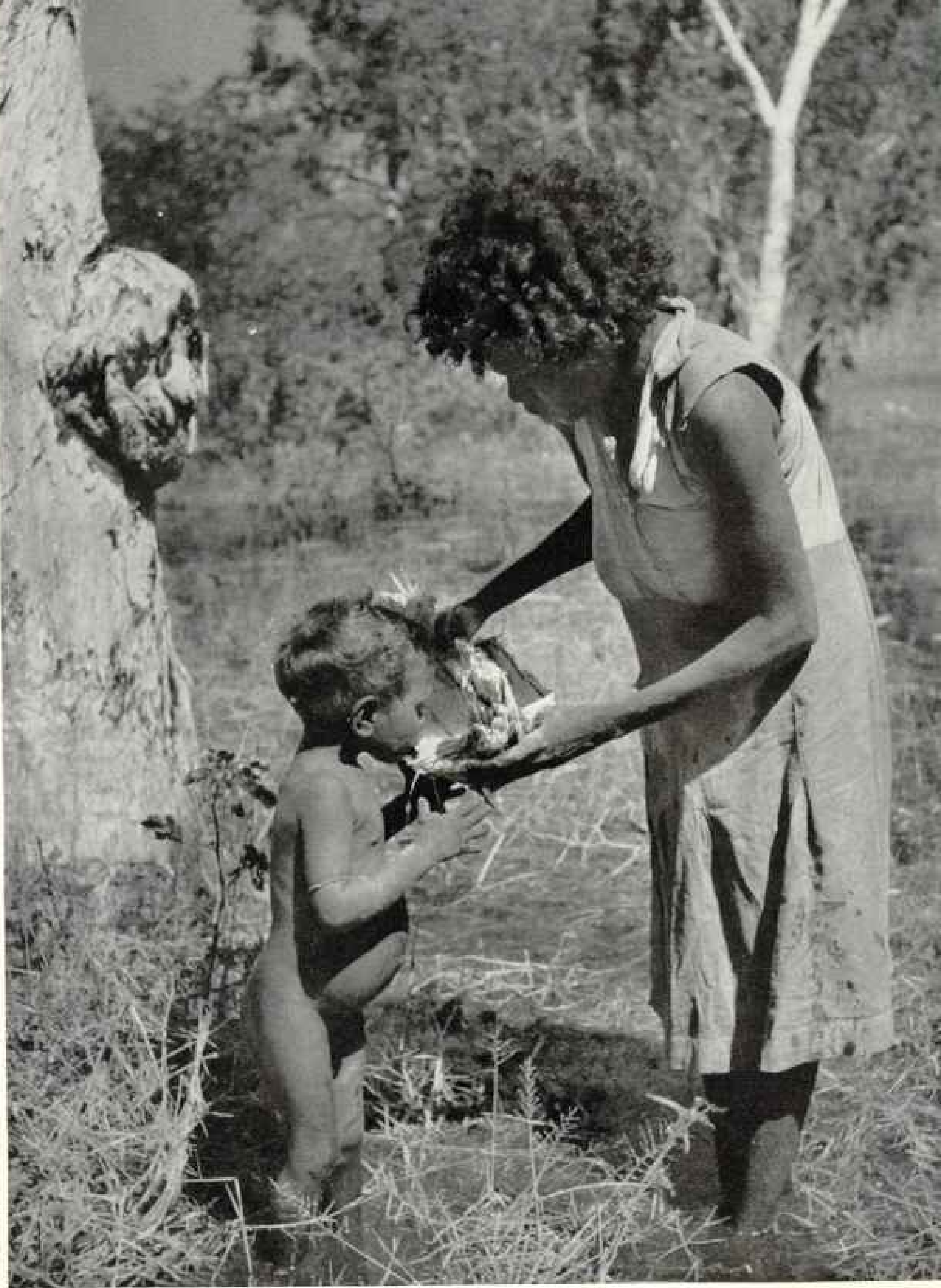
Now, sitting in the shade of a casuarina, men and boys fell to in earnest. Had they forgotten me? Eagerly I awaited the offer of a juicy shoulder steak; but it didn't come.

I wouldn't call these aborigines rude or selfish; I'd never known them so before. Perhaps they felt it would embarrass me to eat blackfellows' meat.

I later learned that in such circumstances a white man must speak up or else go hungry, as I did.

Actually, Groote Eylandt natives possess a generous nature, and they share fairly among themselves. If six have an inch of plug tobacco, they divide it evenly. A white man like myself, critical of any discrepancy in their policy, may well blame himself.

On the homeward trek from Amarepa I felt weak and tired. My pack seemed heavier; I kept hoping for a rest. And what a thirst!



Baby Quenches His Thirst from a Paperbark Loving Cup

Mother stripped a sheet of bark, bound the ends, and formed a vessel designed primarily to hold the wild lily roots she gathered from this pond. Cooked in ashes, the roots please Groote Eylandt palates.

My legs, heavy as kegs of nails, ached with each step.

Finally at dusk we emerged from the scrub and could see the garden. It made me feel suddenly as fresh as it looked, except for my gnawing hunger.

The moral of all this is: If you go walkabout with natives, take your own food and eat it; aborigines know how to look out for themselves. On a real walkabout without white company, they carry absolutely no food at all, not even tea. They depend upon their spears, the sea, and the bush to supply them.

Occasionally I went out to the garden just to visit Kulpija, one of the older men. If an aborigine could look like Abraham Lincoln, he came closest of any I saw. His pet corner of the field, and mine too, lay beside a billabong. There the banana grove felt cool as a cathedral.

Close by grew choice vegetables in the "kitchen garden," specially cultivated by Kulpija. In clever pattern he had laid out rows to take every advantage of gravity should the water pump fail, and he kept a large sprinkling can on hand in case the reservoir level fell too low.

Pausing briefly for a smoke in the shade with me, Kulpija seldom spoke. I admired his dignity while he wondered about gravity. He carefully smothered a cigarette between his fingers, put it gently behind an ear, and left to plan a new irrigation channel.

In another section I saw a group of women gathering long grass cut by men clearing ground. They laid the stuff in furrows of a field to be planted to sweet potatoes. Plowed into the earth, the grass helped form humus.

Rewards Make a Difference

I tried to photograph these women at work, but their shyness said no. They hid behind one another or their bundles, stopped in their tracks, or turned their backs.

At first, in fact, my cameras put all natives on the defensive. Even men and boys reacted like wild animals at the flash of a hunter's gun, and little girls showed positive fear.

I used a meter to determine exposure, pointing the instrument directly at my subject. To aborigines who had never before seen one, the thing had an evil eye. (If they level a certain bone at a member of their tribe, he is a goner; he goes off by himself and lies down to die.)

But as time passed, the natives got used

to me and my curious equipment. Males became nonchalant, taking light meter and lenses lightly, and the females ceased to run away.

For being in pictures, I customarily rewarded adults with tobacco, children with lollies. And when they found that I never let them down, their reserve disappeared like smoke in the southeasterly breeze. Soon they were going out of their way to supply human interest in my photographs. In the end, it was I who sometimes had to dodge the natives.

Work in the garden started later than usual when the Grays set up shop at one end of the schoolroom. Once or twice a month they laid out knives, calico, needles, cotton thread, plug tobacco and the roll-your-own kind, along with other sundries.

All the men at the settlement poured past me into the room when it opened for business. They laughed and chattered as they usually do in a gathering, but showed nervousness. The atmosphere was tense.

Problem: What to Buy?

With so little money to spend for so many things they wanted, the blackfellows had to strain their sense of values. I watched them thinking painfully hard about whether they could give precious silver pieces for this or that. Obvious relief followed the most trivial purchase.

Several men I had not seen before showed up this morning at the store. They had jobs outside the garden. One of them was the tall, stringy, bush-headed cattleman. An elderly native known as Number One, he lived like a nomad with a herd of 20 head to provide Umbakumba with beef. He looked wilder than the beasts he pastured in the north half of Groote Eylandt.

The shopping orgy spent itself within an hour. Comparing purchases, customers left by one door as children entered by another. The store reverted to a schoolroom; the settlement returned to regular routine.

Number One and the cattle moved off through the scrub as a friarbird called, "More tobacco, more tobacco."

With Kulpija I walked toward the banana grove by the billabong.

"What name your country?" he asked.

I told him I came from America.

"Longa that place—they bin got 'im good garden like this one Umbakumba?"

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A notable undertaking in the history of astronomy was launched in 1949 by The Society in cooperation with the Palomar Observatory of the California Institute of Technology. This project will require four years to photograph the vast reaches of space, and will provide the first sky atlas for observations all over the world.

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The National Geographic Society and the Royal Ontario Museum in 1951 explored and measured newly found Chubb meteor crater, 11,500 feet in diameter, in northern Quebec.

The Society granted \$25,000, and in addition \$75,000 was contributed by individual members, to help preserve for the American people the Forest of the giant sequoia trees in the Giant Forest of Sequoia National Park of California.

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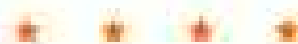
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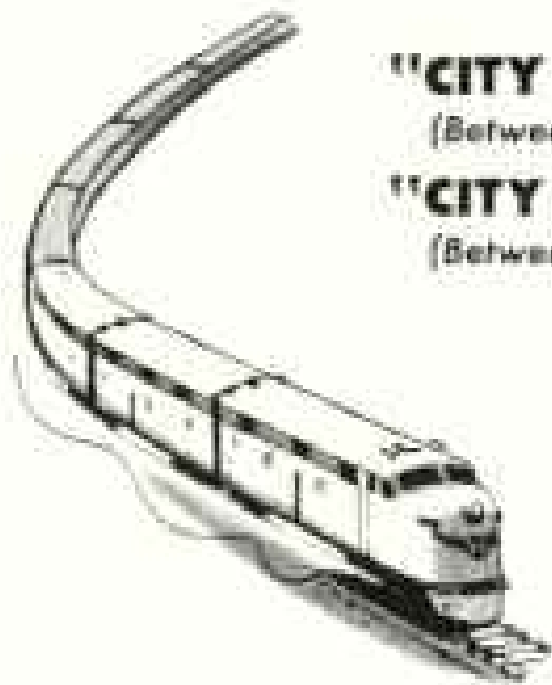
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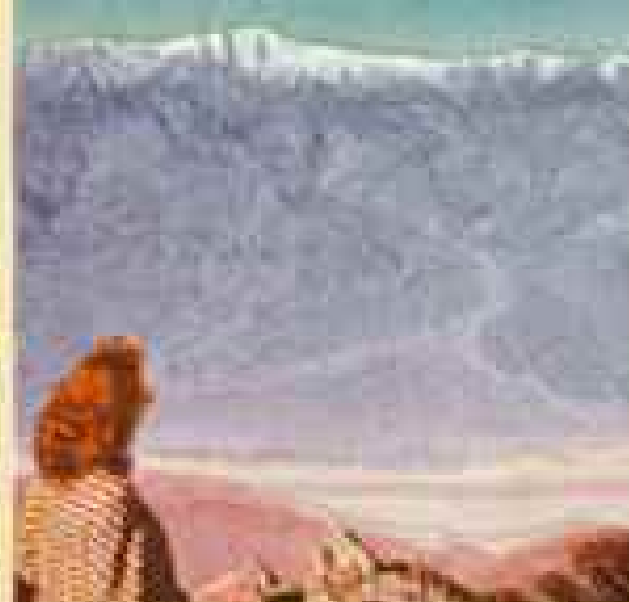
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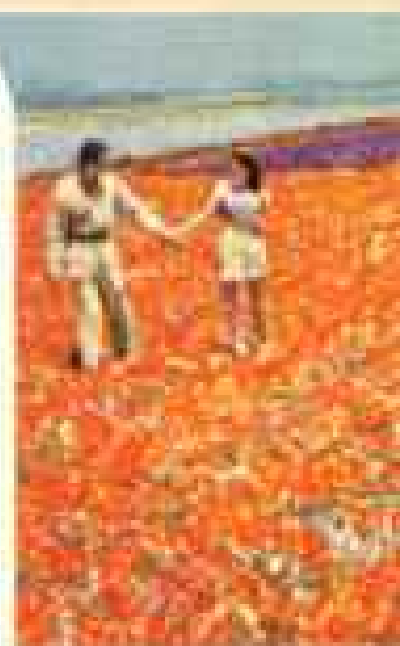
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home at Mill Grove, a farm in eastern Pennsylvania which his father had previously purchased. Here he began to paint the birds and other fauna of his adopted land, devised the first American bird-banding experiment and met Lucy Bake-well who became his wife and remained his lifelong inspiration.

In 1951 in observance of the centennial of Audubon's death, Mill Grove was purchased as a public memorial and bird sanctuary and is administered by the Commissioners of Montgomery County, Pennsylvania.

Audubon's genius as one of the greatest of bird artists and naturalists won him a niche in America's Hall of Fame but in his lifetime success was slow and his wife had to teach to support the family. Not

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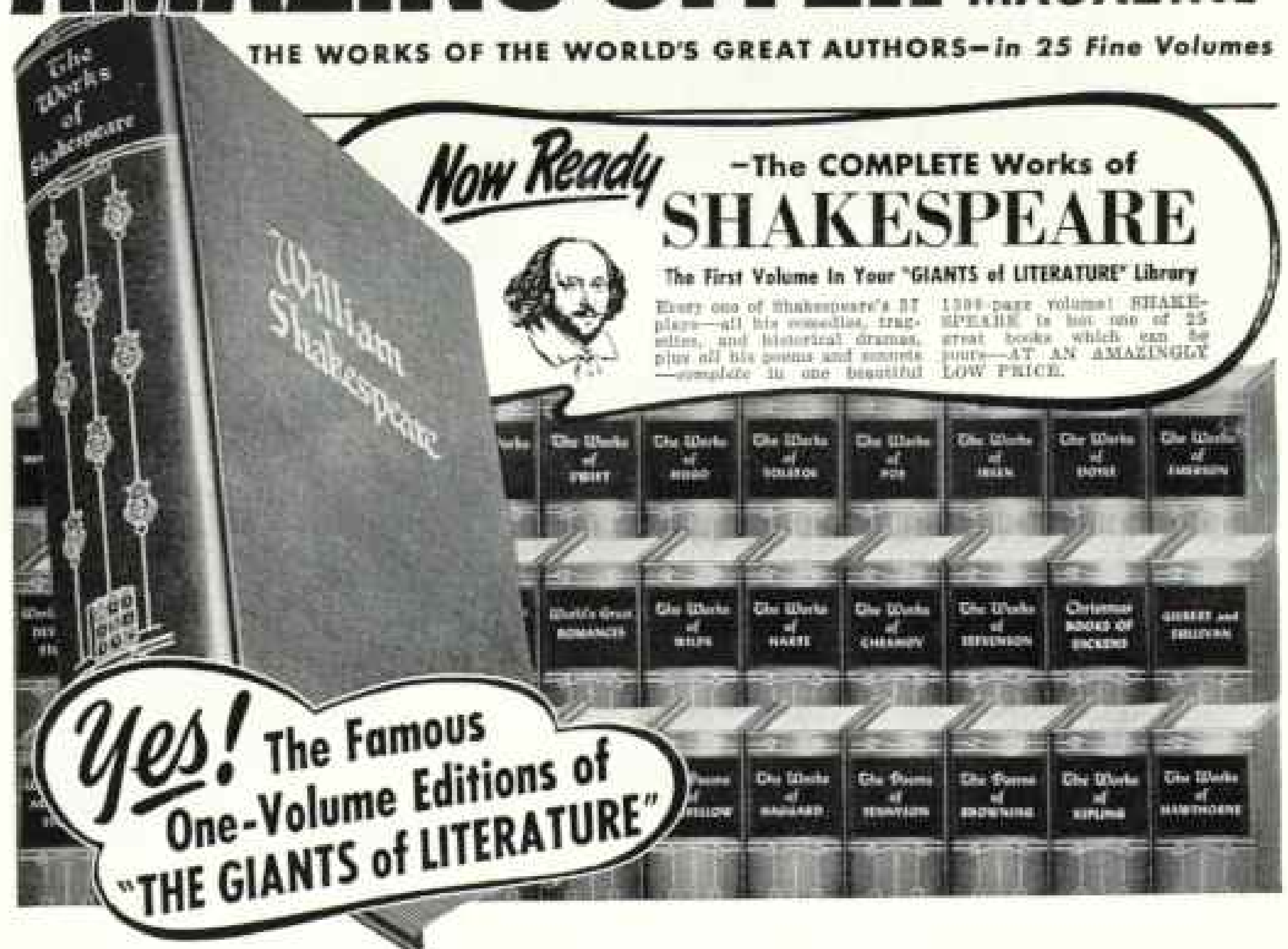
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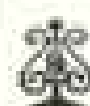
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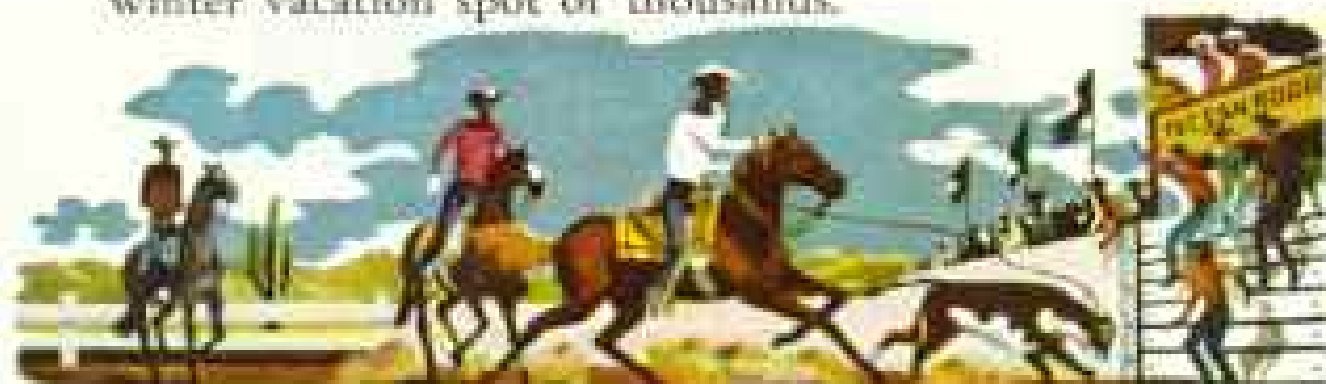
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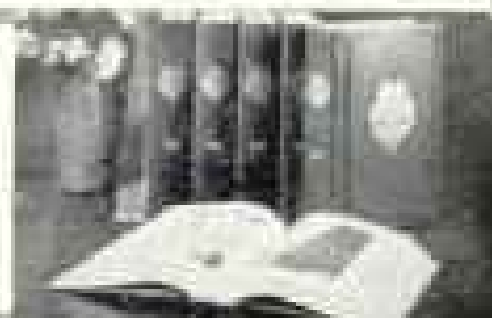
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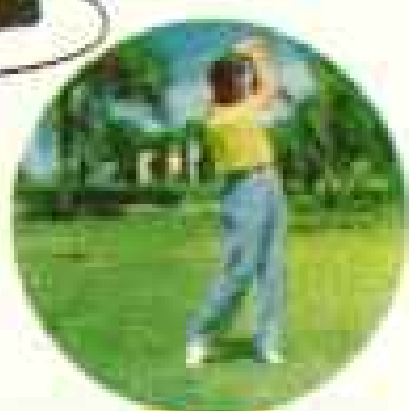
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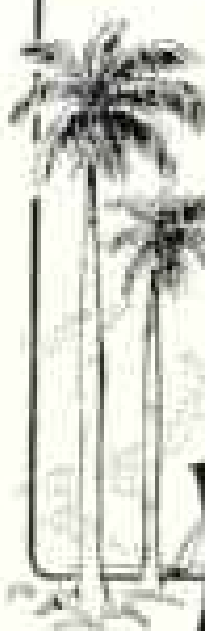
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Many of us regard a cold all too lightly—even when it brings on "a touch of fever." We may say: "It will be gone tomorrow," and, relying on our favorite home remedy, attempt to continue our usual activities.

Doctors take a more serious view of colds. They believe that any cold should be promptly and properly treated. Most physicians believe that the best treatment is simply this:

Remain at home and rest as much as possible, preferably in bed; eat light, wholesome food; drink plenty of liquids; and be sure to check your temperature.

The latter point is particularly important because a feverish cold often indicates the onset of more serious illnesses including the various forms of pneumonia.

In fact, it has been estimated that colds are the starting point for nine out of ten cases of pneumonia. So, in addition to keeping check on your temperature, it is wise to watch out for chills, pain

in the chest or side after coughing or deep breathing, and the appearance of rust-colored sputum. *Should any of these symptoms of pneumonia develop, call the doctor at once.*

Fortunately, medical science has made enormous strides against pneumonia. Just a few years ago, one out of every three pneumonia victims died. Today, modern drugs are so effective that only one out of every 25 cases is lost. This record should not lull anyone into a false sense of security—for pneumonia can still strike and rapidly become serious. Prompt treatment is just as vital as ever.

Good health habits help prevent winter ailments such as pneumonia. So, during the cold months ahead, you may find these simple precautions helpful in conserving your resistance against colds, pneumonia, and other respiratory diseases:

Avoid loss of sleep, excessive fatigue, and over-exposure to extreme cold and dampness.

Eat a well-balanced daily diet.

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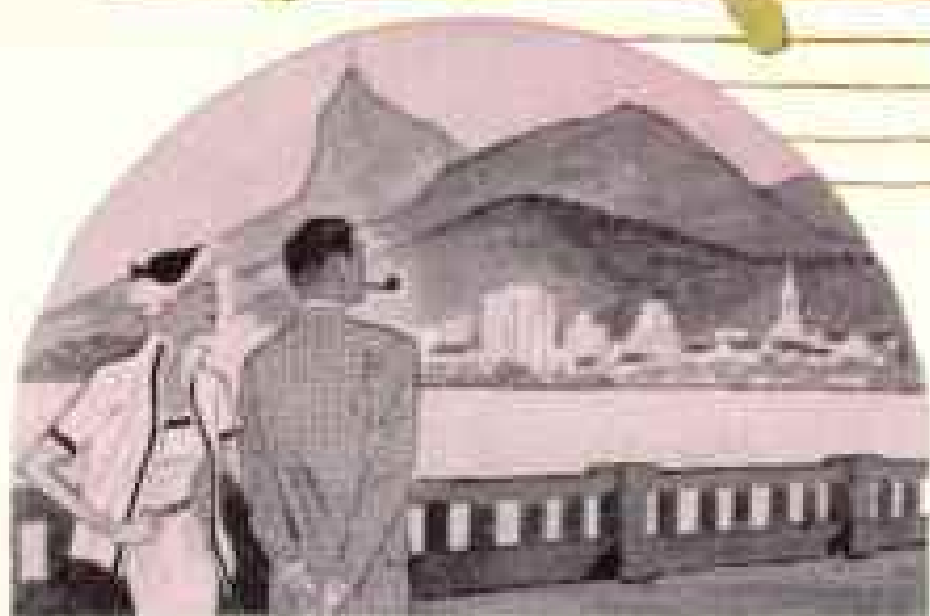
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The great day is May Day, and the children are carrying their Queen o' the May in traditional procession through Elstow, the lovely English village where John Bunyan was born. A month later the real Queen will drive through London to her Coronation in Westminster Abbey. But that's another day, and there's much for you to see before then. A short distance east of Elstow you come to the university city of Cambridge, and thence to Constable's Suffolk and the rest of East Anglia. This smiling corner of England hasn't changed much since the golden

days of our first Elizabeth. The cottages are still thatched with straw, and the walls are gay with the old pink wash. The beer is good, the people friendly with strangers. Here the village bell-ringers still practice the ancient art of change-ringing, and of a Sunday evening you may be lucky enough to hear a Full Peal of Grandsire Triples or Kent Treble Bob Major. Yes, there is much to see in East Anglia this year, when all England will be en fête—along with Scotland, Northern Ireland, Wales. See your Travel Agent now and come to Britain in Coronation Year.

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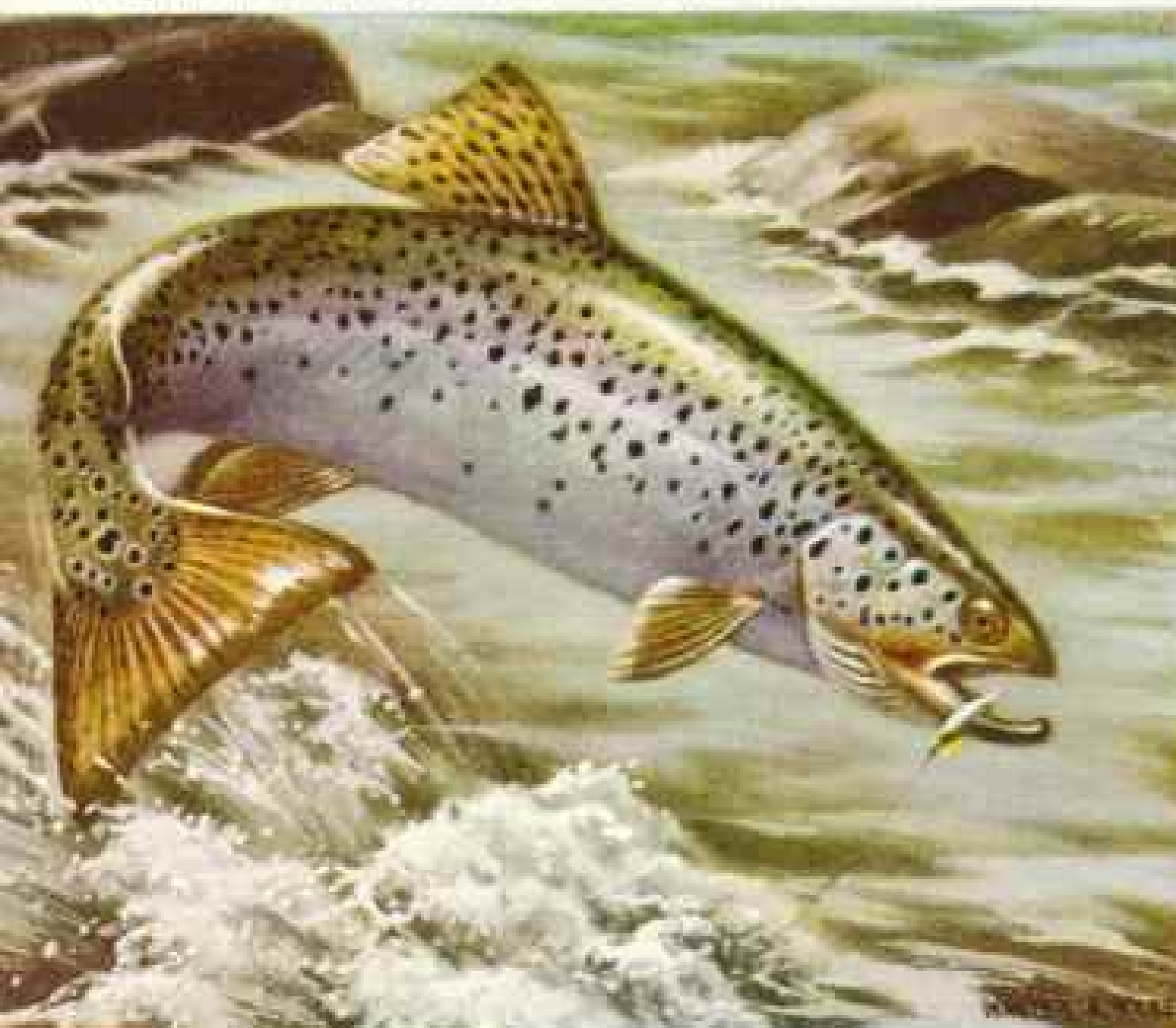
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